A NEW AMERICAN MOTOR-TANKER

NEW YORK SEATTLE

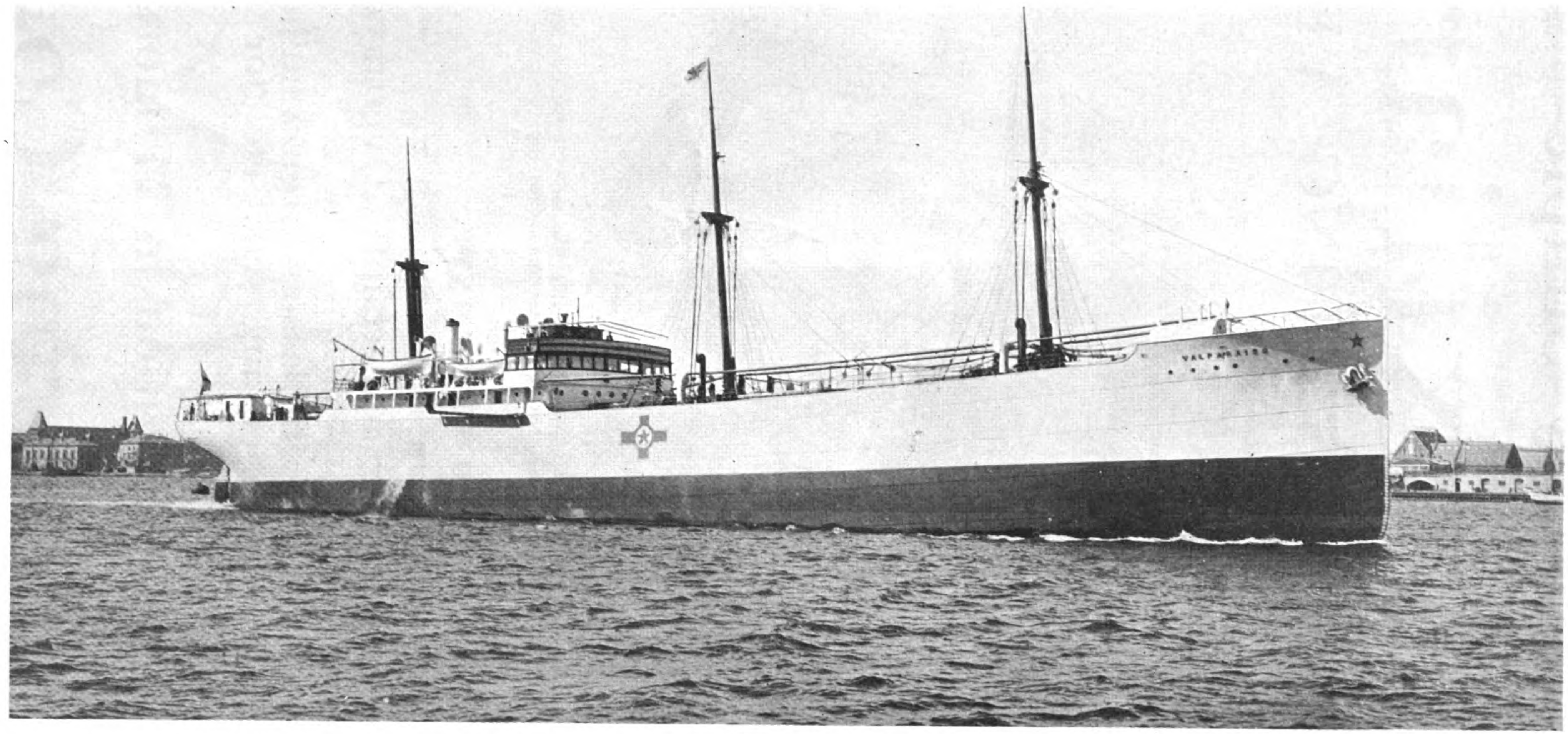
MOTORSHIP

Devoted to Commercial and Naval Motor Craft

"MOTORSHIP" is entered as second-class matter at the Post-office at New York, N. Y., U. S. A., July, 1918, under the Act of March 3rd, 1879.
Office of Publication, 1270 Broadway, New York, N. Y.

Issued Monthly
PRICE 25 CENTS
Domestic, $3.00 per year
Foreign, $3.50 per year

SEPTEMBER, 1919
Vol. 4 No. 9



NOTEWORTHY ECONOMICAL MOTORSHIP—No. 32

Steel M. S. "Valparaiso," one of a fleet of fifteen large motorships of 6,550 tons d.w.c. (7,330 tons actual cargo capacity) each, built and building for the Rederiaktiebolaget Nordstjernan of Sweden (Johnson Line). The above is 362 ft. 0 in. long, 51 ft. 3 in. breadth, 25 ft. 6 in. depth, and is powered with twin six-cylinder Burmeister & Wain Diesel engines of 4,000 I. H. P. each. These engines have cylinders of 21.259 inches bore by 28.740 inches stroke, turning at 140 R. P. M. and giving a speed of 10 knots on a daily fuel-consumption of 7 to 7½ tons. As with many other large European shipping interests, this company has committed themselves entirely to this type of ship in their present construction program. The latest additions to their fleet are of 9,200 tons d.w.c. and 3,000 total I. H. P.

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MOTORSHIP

Trade Mark, Registered

1270 BROADWAY
NEW YORK, N. Y.

71 COLUMBIA STREET
SEATTLE, WASH.

PUBLISHED MONTHLY IN THE INTERESTS OF COMMERCIAL AND NAVAL MOTOR VESSELS AND FOR RECORDING PROGRESS OF THE MARINE INTERNAL-COMBUSTION-ENGINE

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Published by MILLER FREEMAN & COMPANY
Advertising Manager—J. CHARLES RUIF

Manager—RUSSELL PALMER

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Supscription rates: U. S. A. and Mexico, \$3.00 per year. Canada and foreign countries in the postal union, \$3.50. Single copies. United States, 25c. Other countries, 50c.
"Motorship" is published on the 25th of the month, and all changes in and new copies for advertising must be in the hands of the publisher prior to the 5th of each month. Notice of discontinuance of advertising must be given before the 1st of the month, preceding issuance.

Great Britain. W. S. Smith & Son. Ltd., London. Australia. Gordon & Gotch, Sydney & Melbourne.

The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But, one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by the economical internal-combustion power. Steamships are becoming decadent. America, the most important oil-producing country, is to be the greatest motorship-owning nation. Let us all co-operate and assist to make that day soon.

September, 1919 Vol. 4 No. 9

EDITORIAL

THE QUESTION OF SOLID INJECTION

PIONEERS in modern engineering make advances so rapidly that the other manufacturers and users are occasionally confronted with situations that to them are problematical from a business point of view. The result is that the question of meeting these engineering advances is sometimes shirked as long as possible. This has been particularly so in the case of the heavy-oil engine and its construction and use aboard ship, and some vesselowners and shipbuilders are still endeavoring to avoid it. They may hold out until its certain and extensive adoption by others, threatens to jeopardize their trade. There is a limit to the time before them; as in this age of continuous progress, sound engineering developments which are practical commercial possibilities, will never be ignored for long.

In a similar way, a problem now confronts all builders of marine Diesel engines. This is the question of the solid-injection of fuel for high-compression oil-engines. Until recently it was the general concensus of opinion among oil-engine designers that this system was uneconomical and of little use for the heavier grades of fuel-oil. In fact, up to the commencement of the war this was known to be the case. But during the last few years important progress has been made abroad which demands closer investigation and experimenting on the part of our own engine-builders. It has been thought that only one English concern was using solid-injection so it may be well to mention that for several years as many as twenty other engineering companies in Great Britain have been using this system under licenses. This, by the way, is the largest number of constructional licenses granted for any one make of Diesel engines. It indicates the technical opinion of these engineers familiar with the system.

According to our information a consumption of 0.28 lbs. per indicated horsepower (0.38 lbs. per b.h.p.) can regularly be maintained and an even lower consumption has been obtained on the test-bed. This, of course, is remarkable. The economy resulting from such achievements may be compared with the best marine steam-turbine practice; namely, 0.95 lbs. per indicated horsepower, or with 0.30 lbs. for the best air-injection Diesel practice.

With four 6,000 i.h.p. fast cargo-ships of the same power fitted with coal-burning reciprocating steam-engines, oil-fired geared turbines, air-injection Diesel engines and the solid-injection "Diesel" engines respectively, we get the following daily fuel consumptions:—

Coal-Burning Ship	Oil-Fired Turbine Ship	Air-Injection Diesel Ship	Solid-Injection Diesel-Ship
96½ tons	61 tons	19 tons	18 tons

It will be seen from these figures that solid-injection widens the gulf between oil-fired, steam and internal-combustion engines, but that the actual difference in consumption between it and the air-injection system is not very much. Of course, it dispenses with the air-compressor and saves the power absorbed in that manner, and, on the basis of indicated horsepower there is a gain of about 5.2 per cent efficiency per ton of fuel consumed over that attained in engines using air injection.

The figures would have been more effective had we quoted the consumptions per brake horsepower in each instance. Usually steam-ship owners carry in mind the consumption per indicated horsepower; so it may be best to use the more familiar term.

Perhaps it is well to make it clear that there is no desire on our part to suggest that builders abandon air-injection in favor of solid-injection at this stage. We simply intend to indicate the necessity for immediate investigation and experiment. Our own view is quite impartial, except that we naturally lean towards air-injection because we are acquainted with both its merits and weaknesses, whereas, we do not yet know the faults of solid-injection. While abroad we hope to have the opportunity of making further investigations.

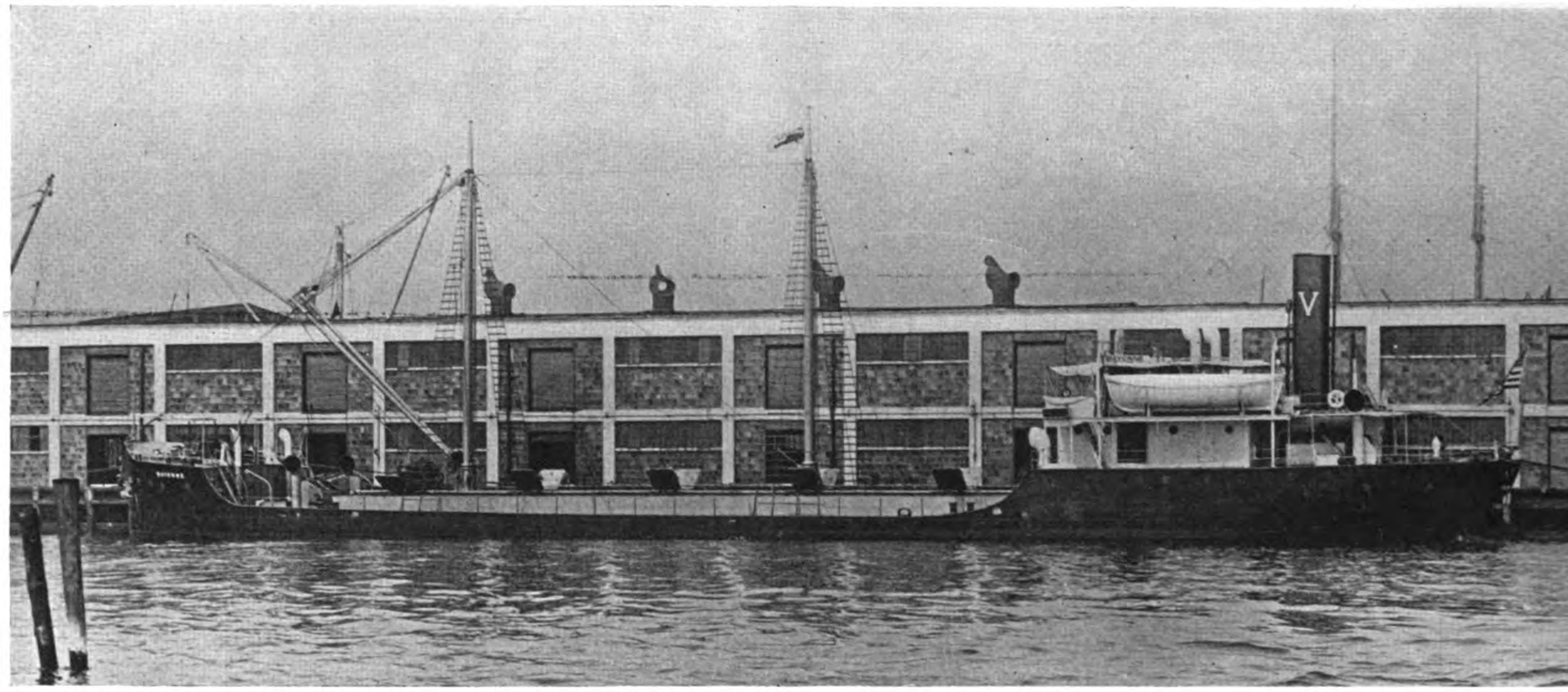


Fig. 1. M.S. "Bayonne" at Vacuum Oil Co.'s dock at Bayonne, N. J. She is 216 ft. 7 in. O.A. and has tank capacity for 528,900 gals. of oil. She is powered with a 500 b.h.p. McIntosh & Seymour engine but fitted with steam auxiliaries

Full Powered Diesel Engined Tank-Ship Under the American Flag

Vacuum Oil Company's New Vessel Has Successful Trial Trip

THE use of the Diesel engine to propel the tank-ship is as inevitable as death and taxes. There is nothing new about the idea but "Motorship' welcomes this opportunity fully to describe the M.S. "Bayonne" and her performance on her trial trip. The M.S. "Bayonne" is a steel tanker built by the Tank Shipbuilding Co., Newburgh, N. Y. on the Isherwood system to Lloyd's highest classification for the Vacuum Oil Co. of New York. Her dimensions and particulars are as follows:

Length over all	216 ft. 7 in.
Length between perpendiculars	208 ft.
Molded Beam	35 ft. 6 in.
Molded Depth	17 ft. 4 in.
Radius of Bilge	4 ft.
Rise of Floors	9 in.
Camber of deck	7 in.
Width of expansion trunk	18 ft.
Height of expansion trunk	3 ft.
Designed deadweight	1,750 tons
Designed mean draft	15 ft. 3 in.
Block Coefficient	0.765
Horse Power Main Engine	500 b.h.p.
Cargo capacity	528,900 gals.
Bunker fuel capacity	54.2 tons
Fresh water for Boiler Feed:	
Fore Peak	44 tons
After Peak	21 tons
Double Bottom	32 tons
Drinking Water—2 Tanks	5.2 tons
Daily Service Tanks—2 Tanks	450 gals.
Lubricating Oil Storage	200 gals.
Propeller—Pitch	6 ft. 3 in.
Diameter	8 ft.
Developed Area Ratio	0.45

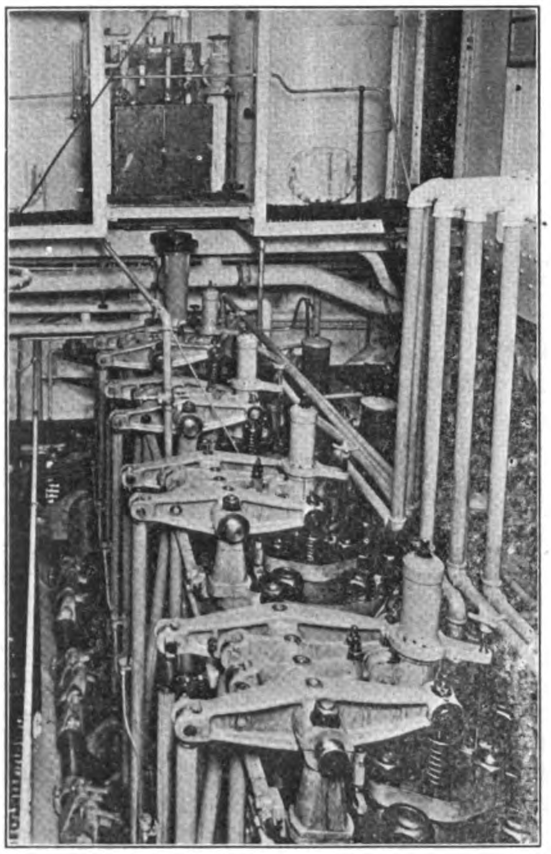


Fig. 2. Looking for'd in the upper engine room showing four of the six cylinders of the main engine. The cooling water discharge from each cylinder head may be seen to the right. The daily service-fuel and lubricating oil filter tanks may be seen in the background

All auxiliaries except the air compressor are operated by steam generated by a Scotch boiler located on the upper deck abaft the engine room bulkhead. The boiler was built by the Vulcan Iron Works and is fitted with a White system mechanical oil burner. Steam is generated at 160 lbs. per sq. in. but the auxiliaries use steam at only 75 lbs.

The adherence to steam auxiliaries is natural. It is necessary to provide for the steam smothering of the cargo tanks in case of fire and also for generating steam for the cargo heating coils. Though the owners are kindly disposed toward oil engines for both main and auxiliary power, they are admittedly conservative. Knowing the merits of the two systems, they have decided upon an installation of internal combustion main engines and auxiliary air compressor, and all steam operated auxiliaries. The installation is reliable, and will give good service, but in the opinion of the owners, the conditions of service preclude the complete use of oil engine auxiliary power. When one recalls the economical results obtained from the electric motor driven auxiliaries installed in many ships, it is to be regretted that these installations are not applicable in the case of oil tankers at present.

Under the plan adopted the engine room force must be made up of both steam and Diesel men. The engine room crew still includes three firemen and the machinery still retains the appearance of the old steam plant. The steam boiler will always be in operation since the cooling water circulating pump is steam operated as are the bilge, fire, sanitary pumps and the electric generator. In port a great deal more fuel will be used when loading or discharging the cargo tanks than when the ship is under way at sea.

However, the boat is well designed and carefully arranged as to details and in all the conveniences and the accommodations provided for the crew. In describing the vessel we will start on the fo'cs'le forward and proceed aft. Little reference need be made to the illustrations which are self explanatory.

On the fo'cs'le head are the anchor windlasses, mushroom ventilators to the quarters below, and the usual mooring chocks and bollards. Accommodations are provided in the forecastle for four men on the port side and six on the starboard side. Under the upper deck, forward are the chain

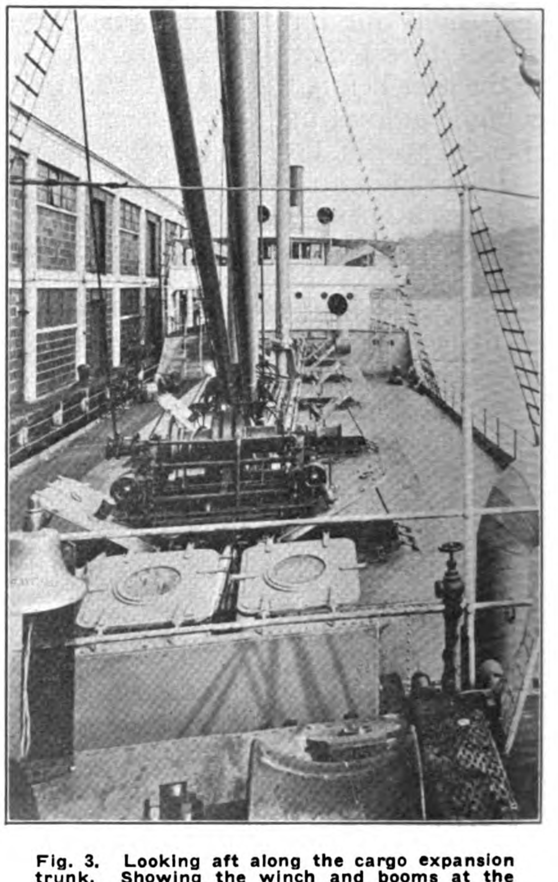


Fig. 3. Looking aft along the cargo expansion trunk. Showing the winch and booms at the foremast and the cargo hatches to each tank

lockers and the storeroom on the centre line just abaft the forecastle there is a small hatch about 5 ft. x 10 ft. which leads to the storeroom. Under the chain locker and storeroom is the forward peak tank, which has a capacity of 44 tons of fresh water for boiler feed.

Aft of the collision bulkhead is the cargo pump room which extends for about four frame spaces fore and aft and for the full width of the ship. Gauges for the steam to the pumps and for the suction and discharge mains from each of three cargo pumps are located within view of the deck.

The pumps are the Duplex horizontal type supplied by the National Transit Pump & Machine Co., Oil City, Pa. The bore and stroke are 10-inch x 6-inch x 12-inch and each has a capacity of 410 bbls. per hour. Pump No. 1 is located on the starboard side and is connected to draw from any tank or from the sea, and to discharge to any other tank or overboard. The suction and discharge piping is 6-inch I.P.S. Crane gate valves are used in the cargo lines. Strainers are fitted in each pump suction. Three separate suction lines are led through the forward tank bulkhead; two of which are on the port side of the oil-tight centre-line keelson.

On the forward bulkhead of the pump room, (the collision bulkhead) is mounted a Dean duplex vertical pump drawing from the pump room bilges, port or starboard the fore peak, or the cargo tanks, port or starboard. A branch from the steam line to this pump leads to the sea chest connected to the suction of No. 1 cargo pump. This is for clearing the sea suction of ice or other foreign matter. Similarly a steam line is led to the cargo suction lines so that all strainers may be freed of any refuse or thick oil which may clog up the strainer baskets in any tank.

Aside from the piping arrangements in the pump room, the remaining item of interest is the microphone receivers for submarine signaling. These are supplied under a rental agreement by the Submarine Signal Co. of Boston, Mass. The need of such an aid to navigation is apparent as the ship will operate up and down the Atlantic Coast and carries no wireless equipment. These microphones are placed on the shell of the vessel below the light load line on either side of the ship. The sound waves set up by a signaling station are intercepted by a disc which is in direct contact with the sea. The consequent action of the receiving mechanism has a basic principle similar to the ordinary telephone receiver and need not be described in detail.

Returning to the upper deck we find that all the discharges from the cargo pumps below terminate

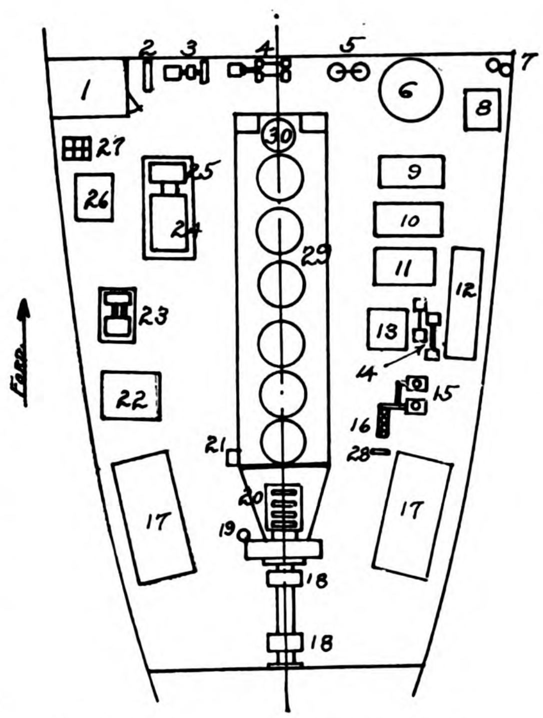


Fig. 3. Diagram of machinery arrangement

in separate stand pipes, all fitted with gate valves. The discharge from pump No. 1 is to starboard, from No. 2 to port or starboard and from No. 3 to port.

Immediateley aft of the pump room hatch is the expansion trunk three feet high running aft about 120 feet to the bridge end bulkhead.

About 10 feet from the forward end is the foremast fitted with two cargo booms. The winch for this work is placed on top of the trunk forward of the mast and is a double drum steam winch supplied by the Lidgerwood Mfg. Co. This equipment was added as an after thought and should prove very useful in many ways.

All cargo tanks are fitted with hinged hatches on the top of the expansion trunk and on each hatch is a bronze pressure-relief valve. There are ten tanks in all—five to port and five to starboard with a total capacity of 528,900 gals. The piping connects each tank with any other and all valves are controlled by hand wheels mounted on long spindles which extend through stuffing boxes in the expansion trunk top. These valves indicate the piping systems installed. They are as follows:

Ten steam valves to the heating coils which are 1½-inch pipes running fore and aft over the entire extent of the bottom.

Ten drain valves for this steam heating system. The steam and water is drained back to two traps in the engine room and mentioned later.

Ten 6-inch valves for the cargo suction line.

Ten steam smothering valves.

Ten 2-inch valves for cargo suction.

All piping is led along the centre line on the top of the trunk and consists of the following lines:

Steam to the pump room, anchor windlass, cargo winch, cargo heating coils, showers and quarters.

Water pipes to quarters for showers and sanitary purposes. Four electric conduits.

Each tank is made individually oil tight so that anyone may be left empty or adjacent tanks may contain different oils. This last is important as the vessel is intended to supply existing storage stations with the various products of the company's refineries, as well as to transport the crude oil to the refineries.

The last four feet of the expansion trunk just forward of the bridge end bulkhead is taken up by the thwartship fuel oil bunker. This has a capacity of 54.2 tons of 24° Baume oil. The ship's center line bulkhead is continuous through this bunker and all piping is duplicated for both port and starboard tanks. They are as follows:

2 Four inch filling connections.
2 Steam heating valves.
2 Steam heating coil drains.
2 High suction valves.
2 Low suction valves.
2 Sounding tubes.
2 Manholes.
2 Overflow pipes with gooseneck.

The heating coils in the fuel tanks are placed around the low suction strainer basket and consist of copper tubing about ¾-inch O.D. and wound in coils about 12 inches in dia. and about 24 inches long.

On the bridge deck are accommodations for the chief engineer and captain and four spare staterooms. At the aft end on the bridge deck over the boiler room is an enclosed space which houses the muffler and steam drum on the donkey boiler. This muffler is very efficient and is simple and

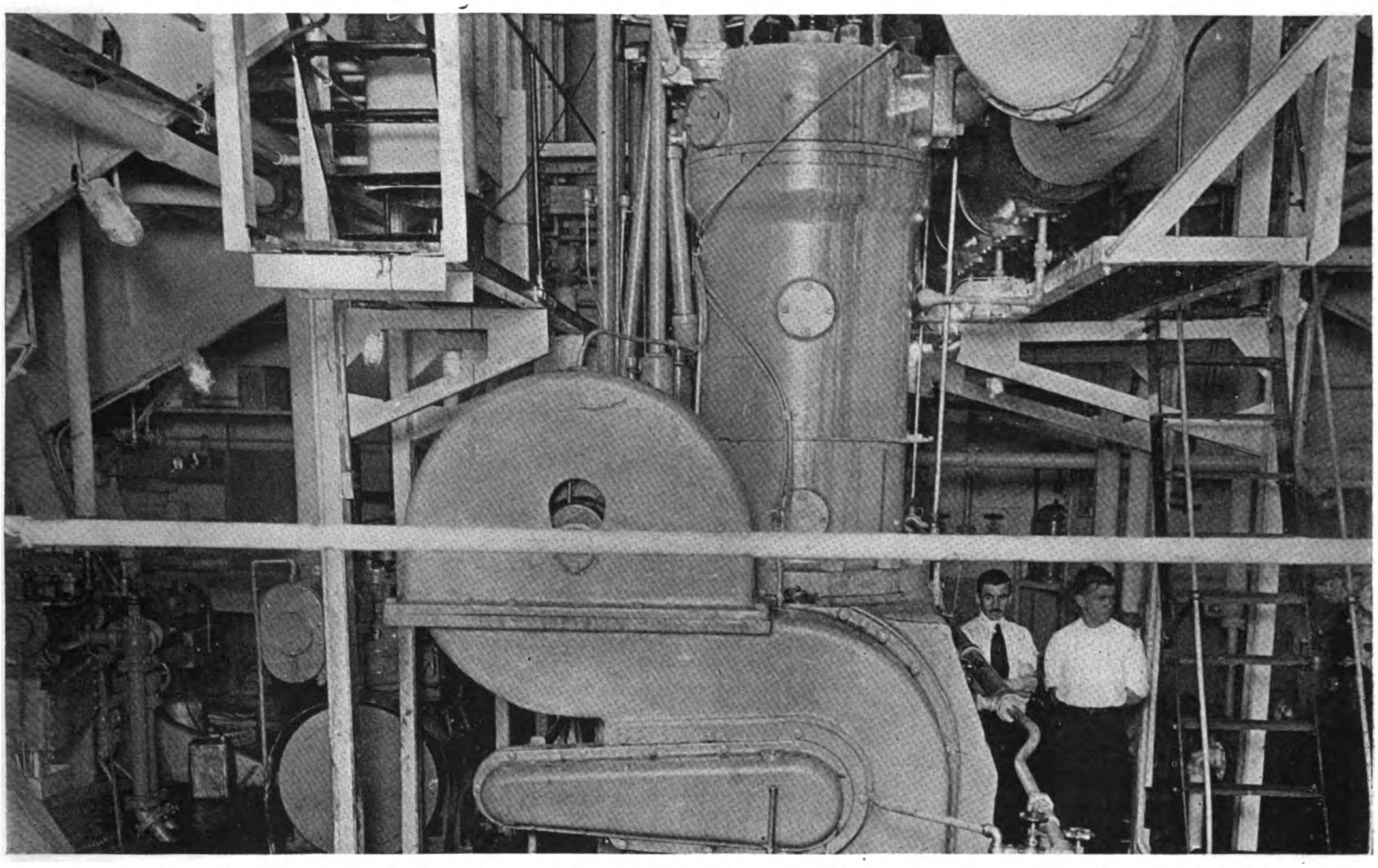


Fig. 4. Looking for'd in the lower engine room. To the left may be seen the 3 cyl. Fairbanks-Morse auxiliary. Mr. Westley, Chief Eng'r, is standing to the extreme right

economical to construct. The exhaust gases and the uptake from the boiler are piped into the same stack which is elliptical in cross section. This arrangement provides in effect an induced draft for the boiler when the main engines are operating.

The White system of mechanical fuel burning is installed and the unit is complete with duplicate fuel strainers, heaters, pumps, etc. About 100 lbs. pressure per sq. in. was maintained on the fuel line to the burner and preheating was carried to 200° Fahr. Steam is generated at 160 lbs. and although pressures used by the auxiliary machinery may be varied at will by means of the reducing valves the following pressures were maintained during the trial trip:

Turbo-Electric generator.................. 120 lbs.
Steering Engine.......................... 60 lbs.
Engine Room Auxiliary................... 75 lbs.

On the main deck are accommodations for the engineers and deck officers and mess boys with the dining room, galley, toilets, pantry, and ice box. These accommodations are arranged fore and aft on either side of the upper engine room casing and boiler room.

Entering the upper engine room from this deck the daily service tanks with a Richardson Phœnix lubricating oil filter tank is seen at the forward end. Directly under this platform, in the fuel line to the engines, is located an Elliot twin-type oil strainer. Mounted on the after bulkhead is the steam steering-engine. Wire rope leads are run aft, overhead in the port and starboard passage ways to the steering quadrant. The usual buffer spring is installed in each lead. Just forward of the steering quadrant is the capstan engine mounted horizontally overhead, directly under the capstan above.

Returning to the engine room and descending to the operating level we may briefly describe the machinery layout by reference to the line drawing fig. (3).

No. 1 Storeroom—wire cage.
No. 2 Switchboard.
No. 3 Steam turbine electric generator.

This piece of machinery consists of a single impulse turbine wheel driving a 10 K.W. General Electric generator at 1,800 r.p.m. There is only one bearing provided between the turbine wheel and the motor; both parts being in balance with respect to this bearing. It was supplied by the Steam Motor Co. of Springfield, Mass.

No. 4. A twin Blackmer Rotary pump driven through gears by a single G.E. 1 H.P. motor turning at 1,700 r.p.m. The pumps are used to lift fuel oil from the bunker to the daily service tanks in the upper engine room.

Directly under this pump is the sump tank which drains the dwarf cofferdam space provided aft of the fuel bunker bulkhead.

No. 5 Two h.p. injection air storage bottles.

No. 6 The starting air tank about 5 ft. diameter and 9 ft. high. The normal pressure carried is 350 lbs.

No. 7 Two steam traps for draining the cargo heating coils. The water discharge is led into

No. 8 An "observation tank." Its purpose is to prevent any oil which may leak into the steam coils in the cargo tanks and pass into the traps No. 7 from getting to the filter box or hot well No. 13.

Nos. 9, 10 and 11 Duplex horizontal Worthington pumps 6-in. x 5-in. x 8-in. Either pump may be used for circulating water through the condenser or the main engine.

No. 12 Wheeler auxiliary condenser.
No. 13 Hot well or filter tank.
No. 14 Sanitary pump and a boiler feed pump.
No. 15 General Service Pump.
No. 16 General Service Manifold. This provides:

Suction from or discharge to Bilge,
F. W. Double Bottom Tanks,
Fore and Aft Peak Tanks,
Condenser circulating water or the Sea.

No. 28 Metropolitan Injector, 1 inch.
No. 17 Drinking Water Tanks 5.2 tons.
No. 18 Intermediate shaft bearings.
No. 19 Main Engine turning gear.
No. 20 Four-Collar thrust-block.
No. 21 Lubricating oil sump on main engine.
No. 22 Lubricating Oil Storage.
No 23 Fire and F.W. pump.

Suction	Discharge
Fresh Water Tanks	Fire Line
Sea	Overboard

This is a horizontal Dublex $7\frac{1}{2}$-in. x 5-in. x 10-in. made by the national Transit Pump & Machine Co.

No. 24 Fairbanks-Morse three-cylinder engine direct-connected to a

No. 25 Craig—two stage auxiliary air compressor.

No. 26 Kerosene oil tank—150 gals.

This tank has a pipe connection to the main engine fuel line, and to a spigot for cleaning purposes.

No. 27 Storage Battery for starting Fairbanks-Morse engine.

The engine room crew consists of Mr. Westley, Chief; Mr. Buttle, 1st Asst.; two junior assistants; three oilers; and three firemen.

The trial trip was conducted enroute from Newburgh, N. Y., down the Hudson River to Bayonne, N. J., on Sunday, August 3rd, 1919. When the vessel started at about eleven A.M. she was not down to her load line and before being run over the measured mile she was stopped and her tanks filled with water until the mean draft was 15 ft. 3 in.

The steam steering gear gave a little trouble and seemed to cause excessive vibration. The other steam auxiliaries gave no trouble and everything appeared to be well placed and all machinery suitable for the purpose intended. As stated before to those brought up with steam there is a sense of security and reliability which they miss if they have no donkey boiler aboard and there was the idea in the mind of the owners not to incorporate the many innovations in one vessel at one time.

It is be hoped that in future installations there will be a marked decrease in the amount of machinery calling for the burning of good fuel oil under a boiler.

The returns given by an analysis of the indicator cards taken during the one hour b.h.p. test are as follows:

Average m.e.p................96.57 lbs. per sq. in.
I.H.P. for six cylinder..................... 652.8
B.H.P. for six cylinders................. 509.18
Mechanical efficiency....................... 78%
Fuel consumption per b.h.p....... 0.418 lbs. per hr.
Fuel oil used......................... 24° Baume
R.P.M. 185
Speed allowing for flood tide... 11.2 knots in still water

On board the "Bayonne" during the trial trip were the following: Mr. Ernest Smith, Supt. of Steamship Dept.; Mr. Ernest Rue, Supt. Engr., and Mr. Burroughs, Assistant, all of the Vacuum Oil Co., the owners; Mr. Kindlund of Kindlund and Drake, the designers of the boat; Mr. W. W. Smith, Chief Engr., Federal Shipbuilding Co.; Mr. A. S. Williams; Col. Moore; Mr. Marvel, Supt. of the Tank Shipbuilding Co., Newburgh, N. Y. where the vessel was built and fitted out; Mr. L. B. Jackson of the Texas Co.; and the Acting Editor of "Motorship." McIntosh & Seymour Corpn., the builders of the main engine were represented by Mr. Cooke, Adv. Mgr., Mr. Flint, New York City representative; Mr. Asplund, Foreman of Erecting Shop and Mr. Anderson the resident installation engineer.

As the vessel weighed anchor and swung around downstream she was greeted by a chorus of whistles both afloat and ashore. Answering these with three long blasts she got fully underway and proceeded without any trouble or uncertainty with the main engines. At all times during the course of the trip down the river when the engines were maneuvered and when she docked at Bayonne the engines handled promptly and powerfully. She found her own berth with the same certainty that a steamship could have done.

A Merchant Marine Of, For, and By America

To discourse at the present time on the value of an American Merchant Marine is merely to express axioms and platitudes with which everyone is familiar. The country at large has never realized so fully the advantages to be gained by having a fleet of ships which adequately represents our country trading around the world.

Those who have made shipbuilding and ship operation their life study and those to whom these questions were brought as a national duty in our country's crisis know the inseparable bond between the establishment of a true American Merchant Marine and the encouragement and growth of a thoroughly American classification society.

One of the last official acts of Edward N. Hurley before retiring as Chairman of the United States Shipping Board, was the writing of a letter commending the work done by the American Bureau of Shipping in which he referred to the development of this bureau as extraordinary. "One of the greatest needs of the future," said Mr. Hurley "for the proper maintenance and development of an American merchant marine is a strong organization operating on the lines of your bureau.'

The text of the letter follows:

"Mr. Stevenson Taylor, President,
American Bureau of Shipping,
New York.
Dear Mr. Taylor:

Your letter of July 25th outlining the growth and development of the American Bureau of Shipping during the trying period of the last two years and also giving expression to your opinion and ideas of the needs of the future is to my mind a splendid statement.

The data you give is interesting and illuminating and it would be of very great benefit to have the facts in relation to your organization, its work, growth and development, and its prospects more generally disseminated, not alone among shipping men, where the problem is understood, but throughout the country. It is doubtful whether the public generally appreciate how very important an organization such as yours is to the maintenance and operation of shipping, but it is needless for me to say to you that it is one of the most necessary factors in the successful operation of shipping.

The development made by your bureau is extraordinary, both in personnel and in the character of the work done, and it is beyond question that one of the greatest needs of the future for the proper maintenance and development of an American merchant marine is a strong organization operating on the lines of your bureau and developed to meet the needs as outlined in your letter.

In conclusion I feel that I am warranted in saying that you will have the sympathetic support of the Shipping Board toward the end of developing your organization as you have outlined the plans in your letter.

Very truly yours
EDWARD N. HURLEY,
Chairman."

Mr. Taylor in his letter to Mr. Hurley gave the following figures from the records of ships classed by the American Bureau of Shipping since its organization:

1916	—164 Wood Ships and 39 Steel Ships, Total Gross Tons	216,935
1917	—189 Wood Ships and 34 Steel Ships	259,907
1918	—102 Wood Ships and 101 Steel 1 Composite and 12 Concrete	526,483
6 mos. 1919	—111 Wood Ships and 184 Steel	1,045,314
Ger. & Aus.	1 Wood Ships and 53 Steel	302,879
U. S. Navy	0 Wood Ships and 36 Steel	28,800
	567 Wood 447 Steel 1 Composite 12 Concrete 1027 Ships	2,380,318 Gross Tons

"When the United States entered into the great war," wrote Mr. Taylor, "and the Shipping Board started the building of ships, shipyards, and facilities connected therewith, this bureau had materially increased its staff and resources.

"On May 10, 1918 it was ordered by the Shipping Board that of all contracts, after that date, for steel ships there should be seventy-five per cent passed by this Bureau and twenty-five per cent by the British Lloyds Registry.

"At the time of the signing of the Armistice we had received about seventy per cent, but the cancellations following the Armistice has reduced our proportion of steel ships to 62 per cent, a situation that could not in our opinion have been avoided. We feel however that the time has come when every American support possible should be given to our American Classification Society particularly the full and undivided support of the United States Government."

Expressing the opinion that "an American Merchant Marine can be truly American only when every element that enters into it is American," Mr. Taylor points out that the American Bureau of Shipping has ample facilities and equipment for the survey and classification of all ships built in the United States. "We believe," he said, "that the time is now at hand when the Shipping Board should not permit vessels built under its direction to be classed by any foreign society. We appreciate your efforts as Chairman of the Shipping Board in strengthening and upbuilding the American Bureau of Shipping and we have every confidence that the Shipping Board will now adopt the policy of building all of its future ships under the Classification of this Society to the end that this American Classification Society may be able to entirely fulfill its important function in the development of a truly American Merchant Marine."

Well Known Stationary Oil Engine Company Develops

Solid-Injection Four-Cycle Marine Engine with Medium Compression

By the Acting Editor of Motorship

WHEN a man buys thorough bred stock—cattle, horses, or dogs—he is as much interested in the pedigrees of the animals as he is in their appearance. We seldom think of an engine in quite that way, but the pedigree of an engine indicates that intangible distinctiveness that means, reliability and general inherent "character" which is "built-into" the assembled whole.

A new marine oil engine, which has as its pedigree the accumulated experience of twenty-six years of success in designing and building stationary heavy oil engines together with three years of study and experiment in applying this experience to marine practice, has been completed by the De La Vergne Machine Co. of New York City. It has recently been put through a strenuous non-stop test of two weeks steady running night and day on heavy Mexican fuel oil. The average horsepower developed during the entire period was 399 b.h.p. which corresponded to a brake mean effective pressure of about 57 lbs. per sq. in. This low figure is by no means the maximum mean effective pressure which can be obtained but the policy of the De La Vergne Machine Company is to rate their engines on a very conservative basis and keep in reserve the ability to carry a heavy overload.

The outstanding features of the engine are a system of solid-two-point fuel injection and a moderate compression pressure of 350 lbs. per sq. in. This is lower than is usual with internal combustion engines, but combustion of the fuel is found to be very certain with the system of fuel injection developed by the builders. The test engine herewith illustrated had a compression of 230 lbs. per sq. in. and electric hot coil plugs were used in starting the engine when in a cold condition. The plugs were not used while running or maneuvering. They will be taken off the engine entirely, and the higher compressor provided, before the engine leaves the shop. The resultant combustion pressures should be between 400 and 450 lbs. per sq. in. Injection of oil is accomplished with a fluid pressure of only 1,500 to 1,800 lbs. per sq. in. which is developed in each fuel line, and only during the period of injection.

The cylinder dimensions are 18-inch bore and 27-inch stroke. The crankshaft is of the built-up type with four throws, 8¾-in. in diameter, and attached to the crank webs are counter weights which balance all the rotating parts.

Referring to the illustrations showing the port and starboard side of the engine an excellent idea may be had of the extent to which the designers have simplified the maneuvering and valve gear. It is seen that only three valves are operated by rocker arms above the cylinders and the tops of the cylinder heads are noticeably clear of valve gear.

The cylinders are cast en bloc with an ample water space around each. Numerous handhole plates afford access to the jacket spaces. The lower joint between the cylinders and the combustion chambers may be noticed just above the air starting pipe. The starboard view of the engine shows the valve gear. The cooling water by-pass connections at the cylinder joints indicate that water passages are not cored out through the face of the joints. A copper gasket is used at both joints. Two ignition plugs may be seen entering each combustion chamber. These plugs were used only when the engine was started from cold and were not connected to the supply of current when running and maneuvering.

The fuel line may be seen running from each fuel pump mounted above the camshaft through a combination high pressure union and check valve. Mounted on the side of the combustion chamber is the branch connection to the two fuel nozzles whence the fuel is injected from both sides in the fore and aft line of the engine.

Running up along the columns of the crank case and outside of the camshaft may be seen the suction pipes of the fuel pumps.

The amount of the fuel oil injected into the cylinders is regulated by small by-pass valves mounted on top of each fuel pump.

The control of these by-pass valves is obtained by means of the shaft mounted just above the lubricating oil pipes. The governing gear is to be seen in fig. 3 just forward of the cam gear casing. The horizontal spring loaded rod is connected to the hand control and the short link is connected by the vertical rod to the overspeed cutout control which is mounted in the intermediate gear wheel or the lower wheel whose casing can be seen in Fig. 1. For priming the engine and filling the fuel line beyond the pumps hand gear is provided on each fuel pump. These handles may be seen in a vertical position on the forward side of each pump.

All the views illustrate clearly the lubricating system. This is exceptionally ample as the whole system is in duplicate as may be seen by reference to fig. 6. McCord mechanical and gravity feed oilers are used. Four lines are led from the former to each of the cylinders. Two pipes are led to each main bearing and provision is made for holding the gravity feed wide open temporarily if any bearing is giving trouble and it is desired to flood it with oil. In the present engine the big end bearings for the crank pins are lubricated by banjo rings and a special pump was used to supply oil to the wrist pins. These two latter bearings will, however, be fitted for forced lubrication through hollow shafts, crank pins and connecting rods.

The circulating-water pumps which are furnished in duplicate are seen in fig. 6. The capacity of these pumps is greatly in excess of the requirements of the engine as may be inferred from the chart of the heat balance and also the table giving the temperature of the cooling water discharge during the 14 days test. At the forward end of the engine may be seen the bilge and sanitary pumps attached to the shaft. This arrangement is optional and these pumps may be driven independently if desired.

The inlet suctions which are shown leading downward inside the exhaust header are each fitted with a butterfly valve by means of which the air taken into the cylinder on the suction stroke may be throttled. This is used in running for long periods on light loads and the fuel consumption

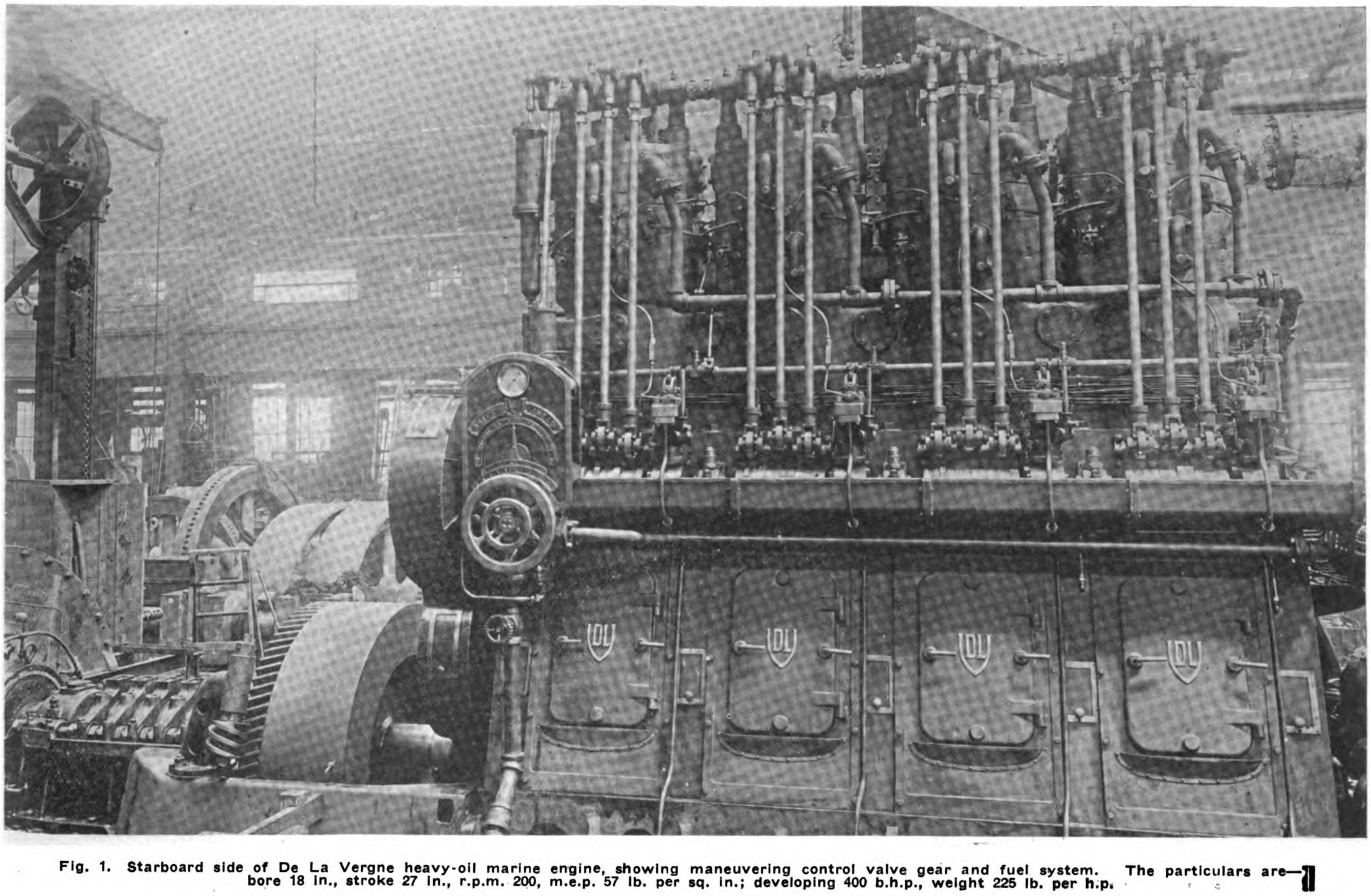
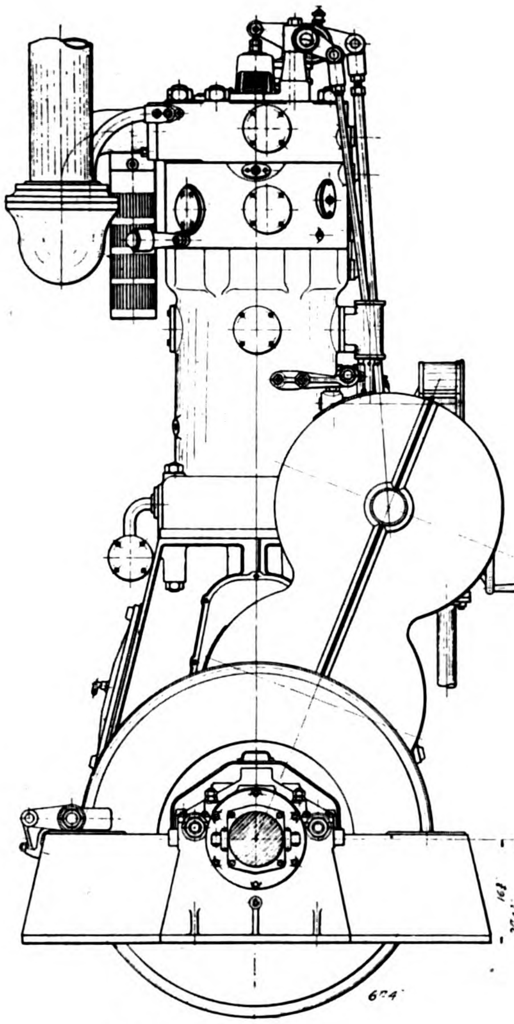
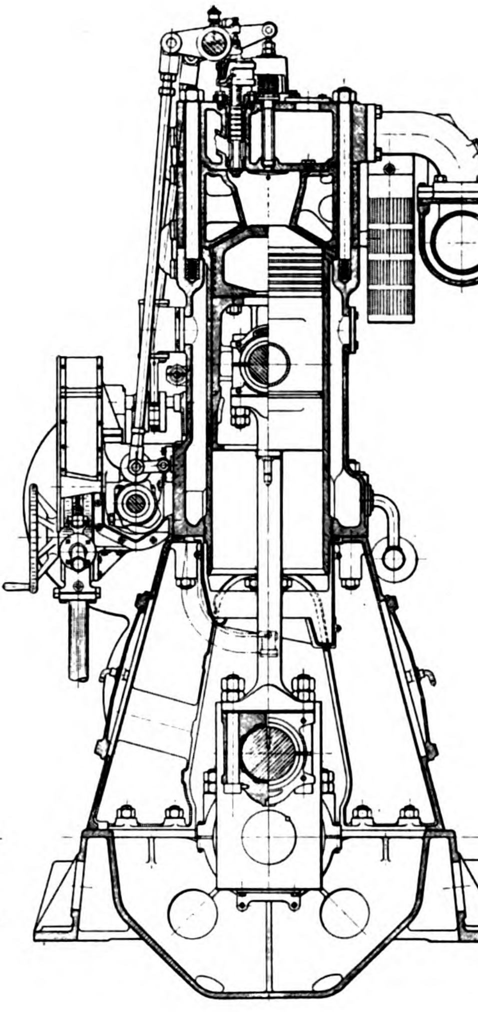


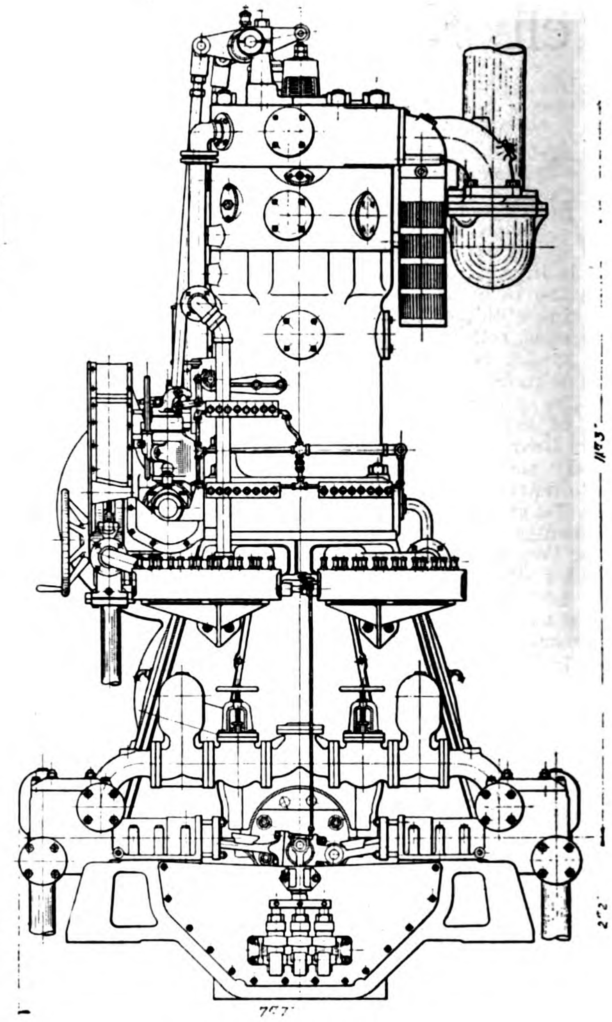
Fig. 1. Starboard side of De La Vergne heavy-oil marine engine, showing maneuvering control valve gear and fuel system. The particulars are—bore 18 in., stroke 27 in., r.p.m. 200, m.e.p. 57 lb. per sq. in.; developing 400 b.h.p., weight 225 lb. per h.p.



Elevation After End



Sectional View



Elevation Forward End

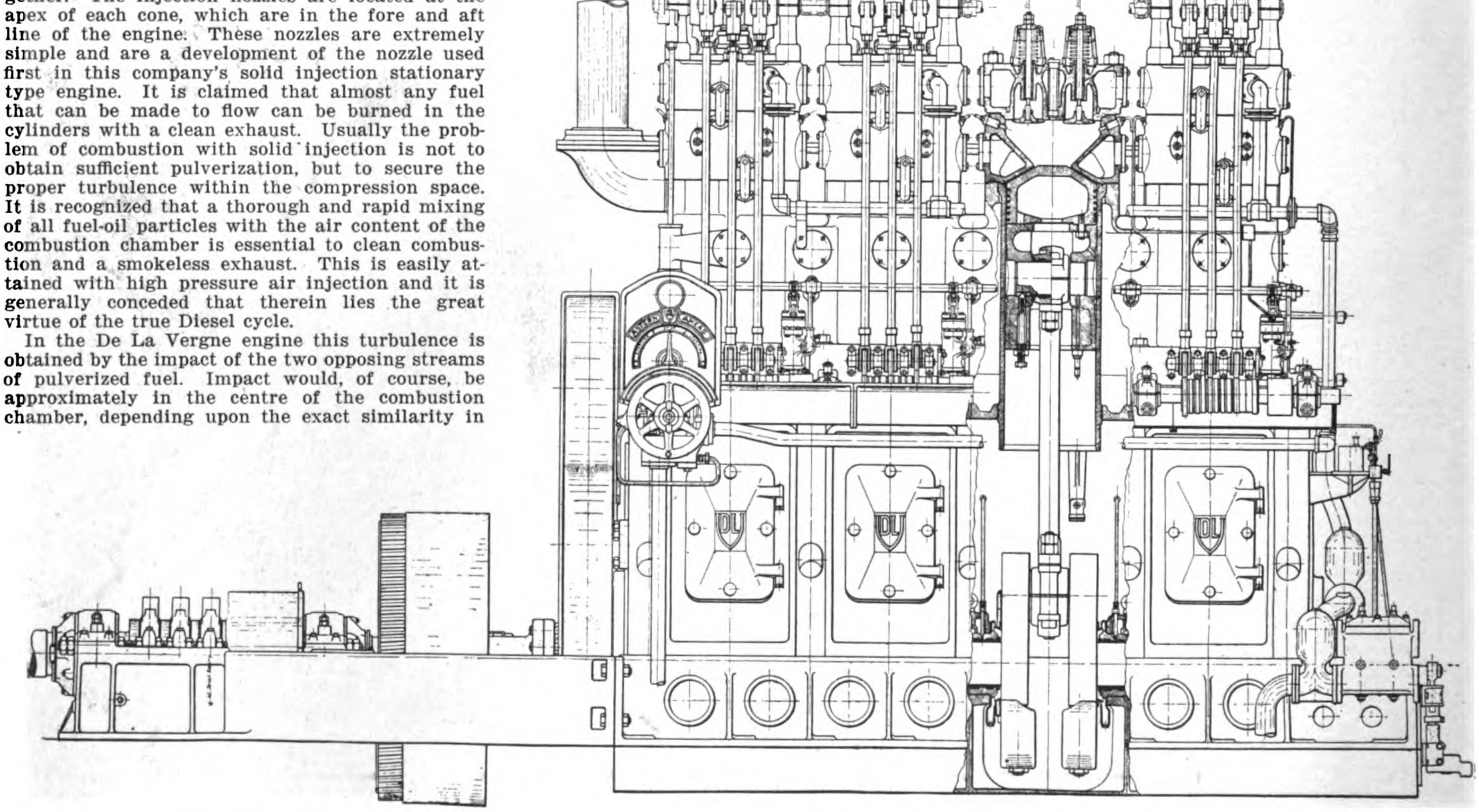
is thereby considerably decreased below that which would result with full compression at light loads. The lever controlling these valves may be seen mounted near the after end of the fuel control shaft in Fig. 1. It was stated that the engine, which normally runs at 200 r.p.m., may be operated at 75 r.p.m. giving 50 b.h.p. which is quite a large range of speed for any internal combustion engine.

The combustion chamber has a form similar to that of two half cones placed with their bases together. The injection nozzles are located at the apex of each cone, which are in the fore and aft line of the engine. These nozzles are extremely simple and are a development of the nozzle used first in this company's solid injection stationary type engine. It is claimed that almost any fuel that can be made to flow can be burned in the cylinders with a clean exhaust. Usually the problem of combustion with solid injection is not to obtain sufficient pulverization, but to secure the proper turbulence within the compression space. It is recognized that a thorough and rapid mixing of all fuel-oil particles with the air content of the combustion chamber is essential to clean combustion and a smokeless exhaust. This is easily attained with high pressure air injection and it is generally conceded that therein lies the great virtue of the true Diesel cycle.

In the De La Vergne engine this turbulence is obtained by the impact of the two opposing streams of pulverized fuel. Impact would, of course, be approximately in the centre of the combustion chamber, depending upon the exact similarity in the action of the two nozzles. This point is of little consequence as it is found that good results are obtained with the use of only one spray nozzle.

The valves are timed only by the pressure of the oil in the fuel line and as both valves of each cylinder are connected with the same fuel pump, the injection should start and end in both valves at exactly the same time.

From the design of the chamber it is seen that approaching the centre from the orifice of either injection nozzle the area of the cross section of the combustion chamber increases. This characteristic form is claimed to provide an ideal condition for the complete dispersal of oil spray throughout the combustion chamber. A test was made by spraying a charge of oil from both nozzles into the combustion chamber when the latter was open to the atmosphere. With the starting coil



De La Vergne 400 b.h.p. heavy oil engine. Note two point injection and conical combustion chamber and detachable piston head.

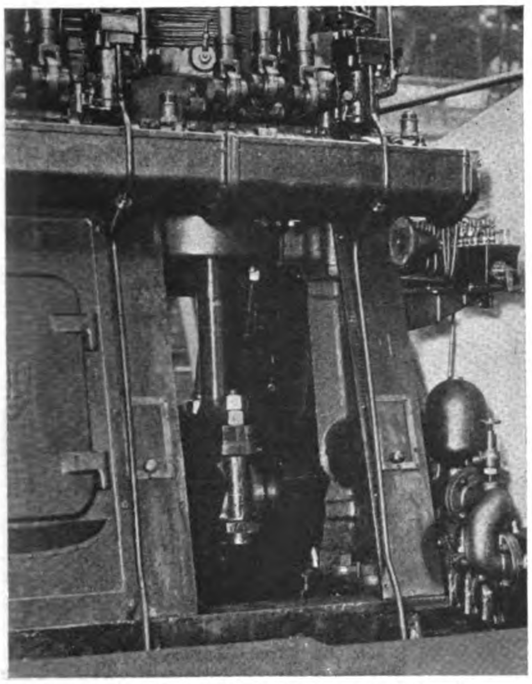


Fig. 2. Showing method of taking out the piston. The large side plates allow easy access.

red hot, the spray immediately burst into flame, although the air of the shop was not heated by compression. It is claimed that this test demonstrates the pulverizing ability of the injection nozzles and shows the benefit derived from the impact of the sprays.

The gears of the camshaft drive are arranged with the small gear on the shaft meshing with a larger intermediate gear. The gears are cut slightly helical (the offset amounts to about one tooth). The intermediate gear is six inches wide. The gear on the camshaft has the same pitch diameter as the intermediate but is only about four inches wide. When running in the reverse direction these gears are in mesh for only about two inches across the face.

The slight helical twist given the teeth adds considerably to the quietness of running and the slight turning of the camshaft, when shifted fore and aft is easily compensated for in the angular position of the cams on the shaft.

The casing for the maneuvering gear with the control wheel is mounted at the after end of the camshaft. Four sets of cams are provided on the camshaft for exhaust and starting valves; two cams for each roller for both ahead and astern running. They are for two-cycle air starting ahead and astern (one each) and for four-cycle ahead and astern starting and running. The inlet valve has only two cams, one for ahead and one for astern. It is not operated at all during the two-cycle starting period.

The sequence of events in the maneuvering of the engine will best be illustrated by describing the operation of starting, reversing and stopping the engine.

When the engine is stopped the gear is in its top position; i. e., the pneumatic ram is up at the top of its stroke—the fulcrum of all the rocker arms being lifted to their highest position and all push rod rollers are clear of the cams. There is no air in the starting system beyond the maneuvering gear control and the camshaft is in its central position of travel for ahead or astern running.

To start the engine ahead the maneuvering wheel is unlocked and the globe valve on the air starting main leading to the engine is opened. This valve is visible just below the maneuvering wheel. Upon turning the wheel to the right or clockwise, the camshaft is shifted to the two-cycle starting position and the valve push rods begin to lower on to the cams. When the camshaft has shifted to its correct position (about one inch travel) the inlet and exhaust valve rollers descend on to their cams and the starting air enters the pipe leading to the collapsible starting-valves. The air pressure separates the two discs and the valve end of the rocker-arm is raised. This lowers the rollers on to the two-cycle air starting cams. As the engine has four cylinders there will be always one ready to receive air so that a positive start is assured under any load.

On account of the weight of all the push rods the gear for this operation is self-acting. After the motion is started the maneuvering wheel turns by itself and when the pointer reaches the mark indicating "2-cycle starting ahead" it is held a second or two while the engine picks up speed. At this point the air ram mounted on No. 1 cylinder is at the bottom of its stroke and further movement of the maneuvering wheel will begin to raise it and the push rods will leave the cams. Upon the slightest movement toward the four-cycle starting position, which is also the running position of the engine, starting air is admitted below the air ram and the gear is lifted quickly without effort by the operator at the maneuvering wheel. The pointer is allowed to swing over to the mark "4-cycle starting ahead." Meanwhile, the mechanism has accomplished the following: The inlet, exhaust and air-starting push rods are lifted clear of the cams (the vertical travel is about four inches which is about twice the lift of the cams) then the camshaft is shifted. The air cylinder is then vented thru slots which are uncovered by the piston and all the push rods again descend on to their four-cycle cams. While shifting from two to four-cycle starting no air is admitted to the cylinders.

The operator will stop the maneuvering wheel at the four-cycle mark and wait for the first explosion on oil in any cylinder. The fuel oil pump control comes into action when the four-cycle starting position is reached. Previous to this time the by-pass valves on the discharge side of the fuel pumps were held open but they now begin to close so that oil is injected during four-cycle starting. At the first firing in any cylinder the maneuvering wheel is turned further ahead. This last movement closes the air starting line at the maneuvering gear control station and vents the piping to all the cylinders. The spring loaded telescopic starting air valve stems immediately collapse and thereby raise the push rods off the cams. This last movement of the hand wheel brings it against a stop and the setting of the fuel pumps is for extreme overload injections. The

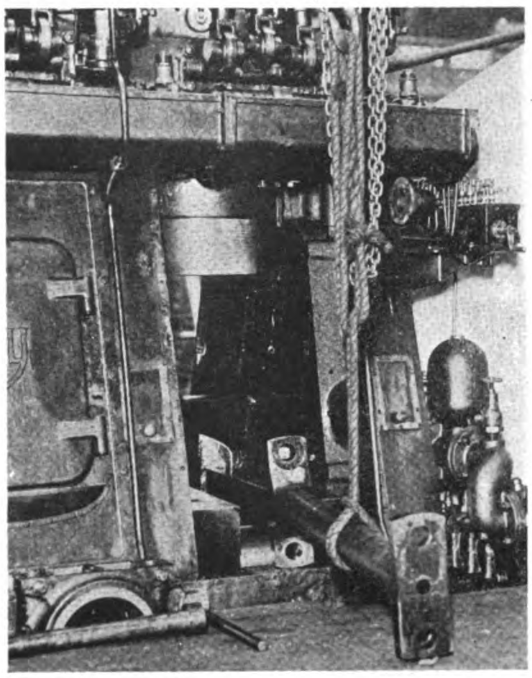


Fig. 3. After the lower-end bearing is taken off the crank pin the upper end may be reached and disconnected.

wheel is then turned back until the required speed is obtained. This backward movement of the maneuvering wheel now has effect only on the fuel pump by-pass valves. The pointer over the fuel scale when returned to the other end of the scale will indicate that no fuel is being pumped and the engine will stop.

In the above explanation several details were omitted to preserve simplicity and to establish the sequence in a connected operation. In studying each operation in detail we find many novel and interesting features. The provision for starting the engine as a two-cycle air motor is most interesting and will be described as follows: Each valve roller has four separate positions on the camshaft in which it may be placed. The inner two are for two-cycle starting ahead or astern and the outer two positions for each roller are the four-cycle starting and continuous running positions, ahead or astern.

Considering two-cycle operation on air it is immediately apparent that the only valves which should function are the air starting valves at every down stroke and the exhaust valves during every up stroke of the pistons. This is provided for as follows: The path for the inlet valve roller is left quite flat, i.e., without any cam on it. The cams under the air starting and exhaust valve rollers are double since the camshaft revolves at ½ crankshaft speed and their period of action is shown in the crank circle diagram Fig. (7). It will be noticed that the exhaust valve when operating two-cycle closes about 130 degrees after bottom centre and compression occurs for the remainder of the up stroke. The result is that when the air starting valve opens at about 5° before top centre the pressure in the cylinder is about 60 lbs. per sq. in. and there is little cooling effect from the expansion of high pressure starting air in a hot cylinder. Incidentally the starting air is intended to be maintained at only 200 lbs. pressure and the ability to start on decreased pressures is conclusively illustrated in the test chart Fig. (8).

Returning to the action of the cam gear it is seen that the fuel pump cams are continuous so that the fuel pump plunger is constantly working. The oil is not delivered to the cylinder, however, on account of the by-pass valve being held open. In many similar instances it may be recalled that the practice has been to bevel off the side of such cams which thus allows the cam to slide under or away from the roller while turning. In the present instance the fuel cam is continuous and due to the difference in angular relation of the cams and the crankshaft for ahead or astern motion this cam presents a twisted appearance. The fuel pump is identical in operation with that used on the De La Vergne stationary S.I. engine.

The operation of the maneuvering mechanism is so adjusted as to the sequence of events that the longitudinal shifting of the cams does not occur at any time when the rollers are below the highest point of their lift when actuated by the cams when working. The excess lift of the push rods beyond reach of the cams is about two inches. Preparatory to starting all pressures in the cylinders are released by pneumatically lifting the spring loaded relief valves.

To stop the engine and reverse the direction of running, the maneuvering wheel is turned to the left. As soon as the indicator has passed beyond the fuel oil scale the by-pass valves are fully open during the discharge stroke of the plungers and no oil passes the injection nozzle in the combustion head. During continuous turning of the maneuvering wheel the push rods are lifted and the camshaft is shifted into the successive position of four-cycle starting and then two-cycle starting ahead then two-cycle starting astern. The manual labor of reversing is very small. The gear being lifted by air, it descends by its own weight and the wheel will spin of its own accord. There are dead centres in the action of the maneuvering gear if the starting air pressure drops and the effort at these points is very slight. The maneuvering may be done by hand without the aid of the pneumatic lifting cylinder if necessary.

This pneumatic cylinder may be seen mounted on the after cylinder. It is connected by a short link to the shaft above the cylinder heads which supports the valve rockers. All the rockers are mounted eccentrically on this shaft and when the latter is turned the fulcrum of each rocker is raised so that the push rod rollers are lifted clear of the cams.

The inclined rod whose upper end is connected

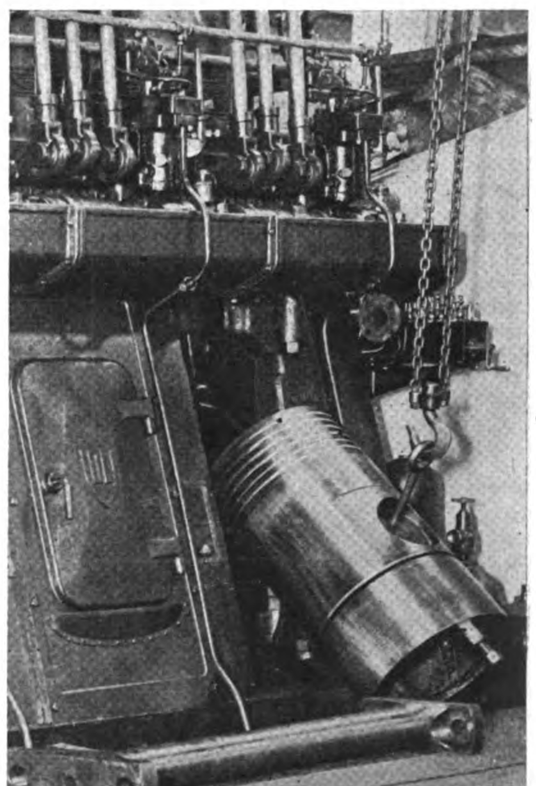


Fig. 4. Showing the upper and lower end of the connecting rod and the method of taking out the piston without touching the valve gear on the cylinder head.

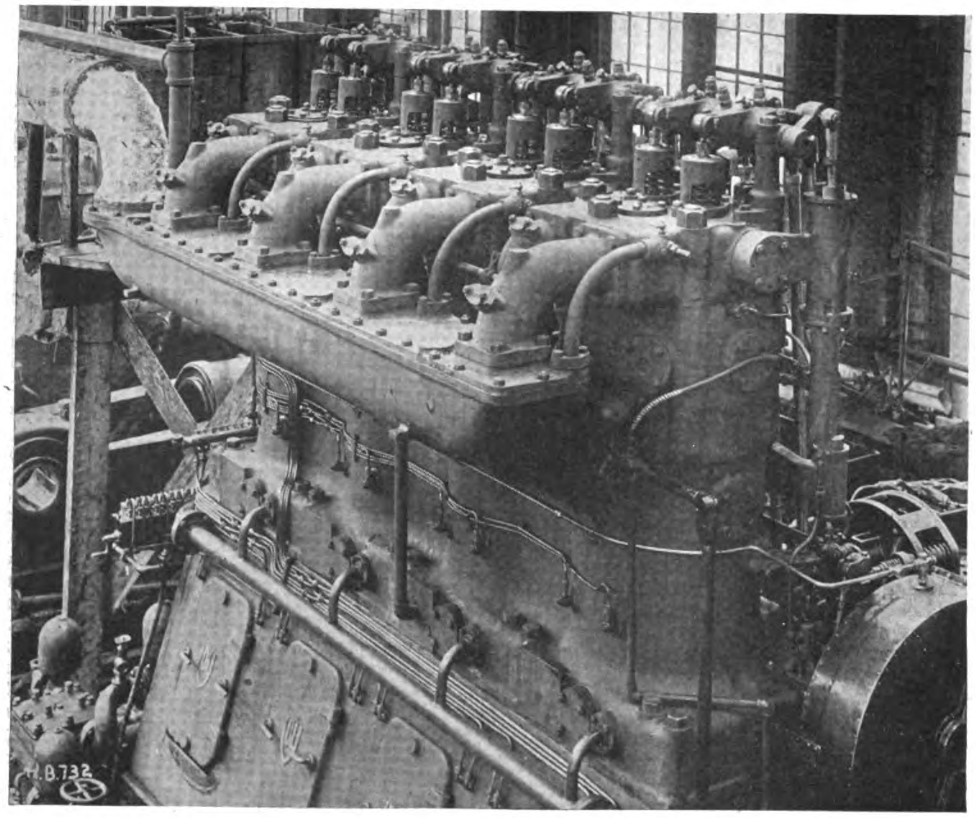


Fig. 5. Showing the cylinder heads, exhaust header and to the right the air-cylinder which operates the maneuvering gear

to the air ram and whose lower end works in a cylindrical guide mounted just above the control gear on the after cylinder operates a crank which by means of gears and links shifts the camshaft forward and aft. Since the maneuvering wheel is always in mesh with the cam shifting gear and by means of the above rod connected to the air ram it turns of its own accord when air pressure lifts or gravity lowers the push rods.

Continuing with a general description of the engine it is to be noted that provision is made for taking out the piston from the bottom. The whole side plate of the crank-case may be taken off in one piece and the oil pan mounted on the lower end of the cylinder liner is removed. This pan is merely a cylinder with a cupped groove on the inside edge which catches all the cylinder lubricating oil scraped down off the cylinder walls and which may contain burned particles of oil. It is an established practice with the majority of engine builders at present to insure that the lubricating oil thrown down by the piston is not allowed to mix with the oil reclaimed from the crankpit. When the piston is at its lower dead centre the bottom nuts of the wrist pin bearings are within reach.

It is to be noticed from the drawings that the small end of the connecting rod is fashioned in a "T" similar to the big end. The wrist pin bearing is split and lined with white metal and is quite similar to the conventional design of an adjustable crank pin bearing. The upper and lower halves in both end-bearings are fitted with set screws which can be tightened against the connecting rod bolts so that when the nuts are removed the connecting-rod may be swung clear and the bearing will remain on the wrist pin or crank pin. The entire piston can then be lowered into the crank chamber and taken out through the side. An attractive feature of such a design is the ability to scrape the upper bearings to the wrist pin at a bench or away from cramped quarters. Also the troubles of refitting a burned or worn wrist pin bearing may be discounted by carrying a spare wrist pin and bearing all ready fitted. This design eliminates the need of breaking the two joints above and below the combustion chamber to get the piston out. If it is necessary to take off the cylinder head the valve gear can be swung away from the cylinder in question by disconnecting the couplings in the rocker arm shaft, taking out two cap screws and the complete rocker arm assembly for that cylinder may be swung out and away. The nuts on the cylinder head studs seem to be easily accessible as are also the valve cages.

Large main bearings are provided in the base which is a very heavy and rigid casting. An extension is bolted to the after end in which is mounted the flywheel and the thrust block. The flywheel has teeth cut into the after edge and the turning gear is a movable worm which may be engaged and turned with a ratchet wrench. A pointer is mounted at the side of the flywheel at its forward edge and the wheel is scribed for all opening and closing positions of the valves and the dead centres of the cranks.

The large side plates of the crank chamber which extend from the after column of No. 4 cylinder to the forward column of No. 1 are provided with large doors held closed by a dog. The cylinder columns are cast with a handhole provided with a sliding shutter enabling the engineer to reach the main bearing caps with his hand.

Referring to the sectional plan, page 30 will indicate the possibility of taking out the crankshaft sideways. The columns may be detached from the top of the bed plate and the bottom of the cylinder castings. This is a tedious job but is simpler than taking it out through either end of the crankcase. At any rate to renew a crankshaft has always been one of the "major operations" in overhauling marine engines and is seldom attempted without shop facilities. The lower main bearing shells may be rolled out without taking out the shaft.

This marine engine has been designed in four, six and eight cylinder units delivering 400, 600 and 800 b.h.p. respectively. The momentary overload of the engine is stated to be 20 to 30 per cent and 10 per cent for two hours is guaranteed. As built, the engine weighs complete with air starting tanks 225 lbs. per b.h.p. It is guaranteed to burn any commercial grade of crude or fuel oil produced in the United States or Mexico, containing not more than 1 per cent water. The consumption guaranteed is as follows:

At full load.................	0.45 lbs. per b.h.p. hr.
¾ load.....................	0.45 lbs. per b.h.p. hr.
½ load.....................	0.50 lbs. per b.h.p. hr.

The oil to have a low heat value of 19,000 B.T.U. per pound. In the test report appended the consumption was 0.41 lbs. per b.h.p. hr. using 30° Baume distillate oil. The compression pressure is to be 330 lbs. per sq. in. with a maximum explosion pressure of 400 to 450 lbs.

The official test report will be given in the October issue.

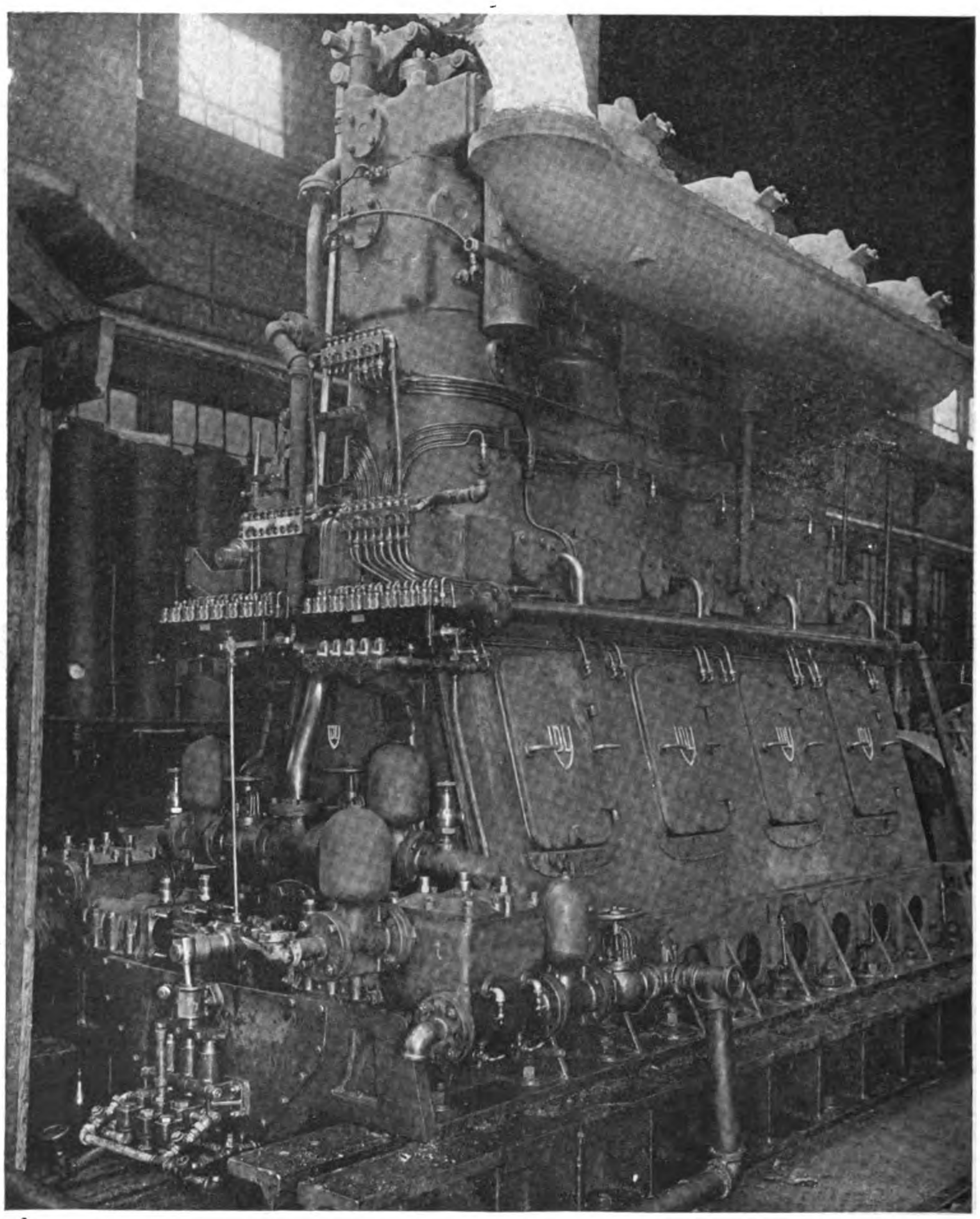


Fig. 6. View of forward end showing duplex lubricating and various water systems. Mc Cord gravity and mechanical lubricators are shown

Jottings from Mid-Atlantic

By the Editor of "Motorship"

On Board the S/S "La Lorraine"

GOING East, pre-war transatlantic traffic conditions are slowly becoming more general, except that there is still a total absence of competition for both passenger and freight traffic. But, to all sea-going men the absence of enemy submarines, mines, and convoying warships brings a great mental and physical relief. No longer need one refrain from smoking on decks, nor is there any need for all ports to be shut and darkened, and all lights screened. The worst enemies of the navigator are again fog and ice. The day that saw Hun shells bursting on the decks of peaceful merchant ships has passed forever. The closest resemblance to a submarine that we have seen is a school of small whales, sighted when nearing the Newfoundland Banks.

One of the first things we noticed aboard the "La Lorraine" was the almost complete absence of vibration. In our cabin, which is about 100 feet forward of amidships, one can hardly notice that the ship is moving, at least on very calm days. At first it made us wonder if the old Nazaire triple-expansion engines had been removed during the war and replaced by turbines. But a visit below quickly dispersed that thought, and the reason of their quiet and smooth running was soon ascertained.

The Chief-engineer advised me that owing to the high cost of full power the engine was developing but 11,000 i.h.p. instead of 20,000 i.h.p. or only about 40 per cent more power than the engines of the twin-screw Diesel-engined motorship "Glenapp." Consequently the boat is only making about 16 knots instead of nearly 20 knots. This I presume is equal to at least one voyage per annum. In other words the high price and scarcity of coal prevents the maximum efficiency of operation—hence the smooth running of the engines. One can well imagine the lost commercial value of the time of the passengers on board due to the voyage lasting at least one day longer than it should, although physically they will gain—if good "sailors"—by the longer period at sea. However in these days most people are travelling for business and not pleasure, so time is money.

There is no sound engineering reason why motor liners of the "La Lorraine's" size cannot be built today, although I should say that a speed of between 16 and 19 knots may be the maximum obtainable for some years to come. A little less than her power would be required because the absence of boilers, coal-bunkers, boiler-water, and condensers would enable the same number of passengers to be carried on smaller dimensions and reduced displacement.

With such a motor vessel the fuel question would never cause speed reduction, because of the ratio of cost to fuel consumption and the efficient operation of this type of engine. For instance the "La Lorraine," at 18 knots at present uses 280 tons of coal per 24 hours, and at 16 knots uses 220 tons. At $6.50 per ton this figures at $1,820.00 per day and $1,430.00 per day respectively.

If of the same power (and being smaller she would not need quite as much power) the motor liner would use about 55 tons of fuel-oil at 18 knots or about 39 tons at 16 knots. With bunker-oil at today's New York harbor prices, namely $10.50 per ton, the difference between 18 knots and 16 knots is represented by an amount so small that it is of very little consequence when a ship of the size and type of the "La Lorraine" is concerned, so she could always be run at 18 knots. These figures are so extraordinary that they may seem impossible but nevertheless they are approximately accurate.

On Board S.S. "La Lorraine." Mons. A. Bordes, New York Director of Compagnie Generale Transatlantique

Let us not forget that the British Admiralty has motorships in service, which have a fuel consumption as low as 0.28 lb. per i.h.p. Furthermore, we have to remember that in dealing with the Diesel engine we have an extraordinarily efficient and economical system of power, and the larger the ship the more astonishing are the savings effected. For the above figures we have used 0.30 lb. as a basis.

On board of the "La Lorraine" is Mons. A. Bordes, the Director at New York of the Compagnie Generale Transatlantique (French Line) who own this ship. We gathered from an interesting conversation with M. Bordes that his company, who also own many freighters, are much interested in the "Diesel-drive" subject and their engineers are investigating the motorship question. M. Bordes is thoroughly impressed with the possibilities and advantages of this class of vessel both for cargo and passenger carrying; but, of course, could not give an official expression at this time, but we understand that the matter comes up for discussion at the next directors' meeting.

When M. Bordes asked our opinion regarding the possibilities of large motor passenger-ships, we pointed out that this really rested with enterprise and confidence of shipowners to order such a vessel, and give the shipbuilders and engineer a free hand. To substantiate our remarks we drew his attention to an advertisement in "Motorship" for July, in which a firm of experienced Diesel-engine builders in a country not far from France offer standardized two-cycle type oil-engine of 3,800 effective (shaft) horse-power in six cylinders or the equivalent of 4,800 steam i.h.p. A triple-screw liner with these engines would therefore have an equivalent of about 14,400 steam-indicated horse-power, but, as before mentioned the two engines of the "La Lorraine" are now only developing 11,000 i.h.p. in the aggregate. In view of the expense that these engine builders have borne, we do not consider such a ship today would be a risky experiment, but a practical commercial proposition. The operating engineers could receive their training in the work-shops while the engines were under construction. The gain to the owners would be enormous, because at full speed (possibly about 18½ knots) the fuel consumption would only be 64 tons per 24 hrs. day. This is based upon the engine-builder's guarantee of 0.42 lb. per effective horsepower which, by the way is by no means the lowest consumption obtainable today. Also this consumption is greater than that previously mentioned as the power is higher.

We have not had the opportunity of noticing the seaworthy qualities of the "La Lorraine"; but, judging by her performance in medium weather, we should say she is fairly dry and steady in heavy weather. Of course she is not a new boat, being nineteen years old.

During a conversation with Mr. Alberto de Verastegui, the managing-director of the Export Department of Babcock and Wilcox Co. of New York, who is on board we obtained an idea of the tendency of shipowners to turn to oil-fuel—in this case to its use under boilers. This is but the initial stage to its general adoption with the more economical internal-combustion engine. His firm alone has fitted oil-burners to marine boilers aggregating close to 2,000,000 horsepower during the past 40 months.

Possibly not all shipowners are aware that many years ago the parent English house of Babcock and Wilcox anticipated the motorship movement, and demonstrated considerable foresight by securing the sole rights in Great Britain for the Nürnburg (M.A.N.) Diesel oil-engine. They disposed of construction rights to half-a-dozen British shipbuilders including Yarrows of Glasgow, and Sir. Wm. Armstrong, Withworth and Co., Newcastle-on-Tyne, and we remember discussing the Diesel question with them about eight or nine years ago.

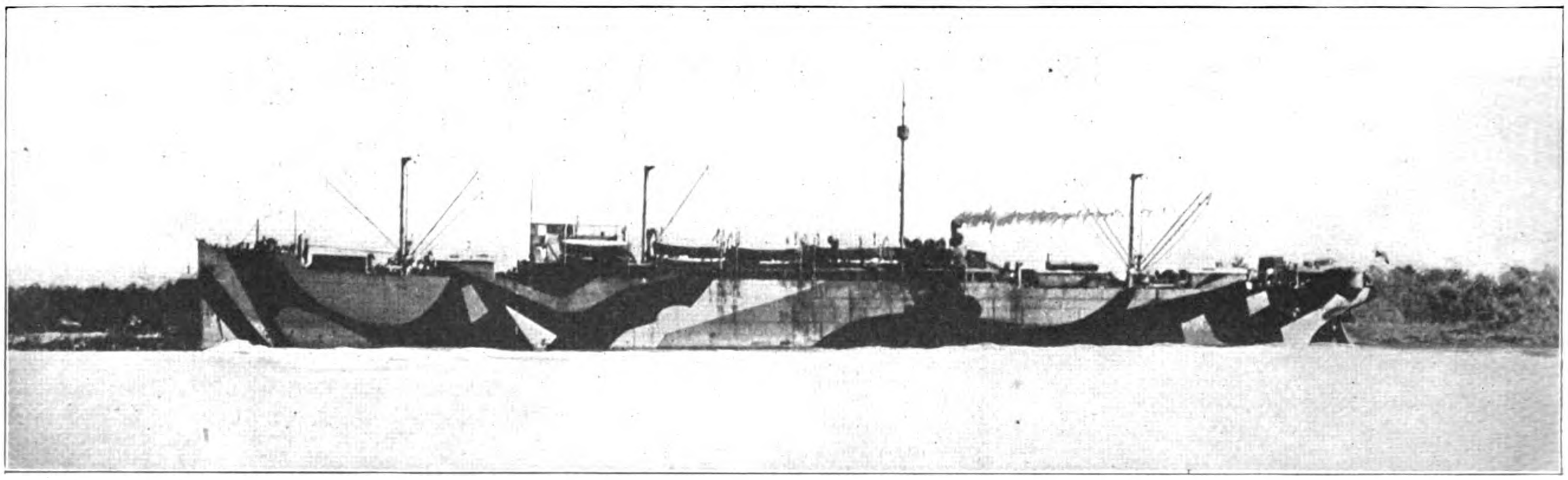
Another notable person on board is Ysaye the Belgian Violinist who delighted the passengers by some wonderful playing in aid of the Belgian Widows' fund.

PORT SCAVENGING OF TWO-CYCLE DIESEL ENGINES

Particular attention is invited this month to "Motorship's" Patent Record to be found on page (43). The patents there described give exceptional insight to the various methods proposed for port-scavenging of two-cycle engines, both single and double-acting types.

This question has long been the subject of many patents and has been closely studied by all designers interested in the development of two-cycle engines.

The material was assembled for the particular purpose of showing very clearly the trend of modern invention in this respect and our readers will undoubtedly find considerable food for thought in the various ideas proposed.



The 6,600 h.p. British motorship "Glenapp." Three additional Diesel-driven vessels of this power are under construction for the same owners. Although of 14 to 15 knots speed, the daily consumption of oil is only 24 tons

Three 13,000 Tons D.W.C. British Motorships

Seven Additional Diesel Driven Vessels Aggregating 80,000 Tons Under Construction for the Glen Line, Making a Total of 14 Motorships. Eight Other English Companies Have Motorships on Order

By the Editor of "Motorship"
Paris, July 25, 1919.

IN our issue of June we referred to the launching of the cargo and passenger motorship "Glenade" for the Glen Line at Harland & Wolff's Govan shipyard. This vessel makes the seventh large motorship built for this progressive British shipowning company.

On July 10th the eighth Diesel driven vessel was launched for the Glen Line. She is the "Glenariffe," a cargo motorship of 10,300 tons d.w.c. She forms part of a fleet of seven additional motorships now building for the same owners, of which three will be of 13,000 tons d.w.c. and of 6,400 horsepower. Each of the larger ships will be propelled by two eight-cylinder B. & W. engines of 29.527 ins. bore by 59.0552 ins. stroke, constructed in England and designed to develop 3,200 I.H.P. at 120 R.P.M. or 3,000 I.H.P. at 100 R.P.M continuously. One British motorship of this power, namely, the "Glenapp," is already in service, and was described and illustrated in our issues of February and March last. She also belongs to the Glen Line.

The new vessel "Glenariffe" has the following dimensions:

Deadweight capacity	10,300 tons
Gross tonnage	8,250 tons
Length	436 tons
Breadth	55 tons
Power	3,600 I.H.P.
Speed	10¾ knots
Engines	Twin six-cylinder Diesel 26.378 in. x 39.370 in. at 125 R.P.M.

Incidentally we may mention that the motorship "Glenade," which was launched on April 15th, ran her trials on June 12 and is now in service. The seven vessels now building for the Glen Line will, when completed, bring this company's motorship fleet up to 14 craft—all over 5,000 tons d.w.c. They will have Burmeister & Wain type Diesel engines built in Scotland.

Other British companies who have large Diesel driven motorships on order are the

Bibby Line.
Lamport & Holt Line.
Elder Dempster Line.
Leyland Line.
British India Steam Navigation Co.
British Admiralty.
Wm. Doxford & Sons (shipbuilders).
Anglo American Oil Co.

Lord Leverhulme is preparing to order some motor trawlers, and, as is known, Sir Thomas Royden has in service a motorship of 14,750 tons displacement.

The present high price of coal in Great Britain is now awakening British shipowners to the value of the heavy-oil burning motorship for cargo and passenger work. As there seems to be little chance of the price of bunker-coal dropping any appreciable extent during the next three or four years, there is likely to be many more motorships ordered by British shipowners before the end of the year.

We are pleased to say that a few days before we sailed for Europe the General Manager of one of America's largest shipowning companies advised us that the directors had definitely decided that if they do build any additional vessels they will be Diesel-engined, and that no more steamships will be ordered.

It will be interesting to see how the uneconomical oil-burning steamships built in the United States during and since the war will compete against the economical motorships of Great Britain, Norway, Sweden, Denmark, Holland and Italy. What will become of the great American merchant fleet promised by Mr. Hurley? Unless all the ships built in America during the war are quickly converted to Diesel power, it will not be long before they will be laid up or sold to other countries. Now that the work of the Shipping Board is diminishing, surely it is time for shipowners to follow the example of the above British companies and take quick action!

Official Report on First Shipping Board Diesel Engine

30-Day Non-Stop Full-Power Test of McIntosh and Seymour 750 b.h.p. Marine Engine

THE engine to which this report refers is the standard McIntosh & Seymour Corporation heavy duty, Diesel Type Marine Engines, rated at 960 i.h.p. or 750 b.h.p. at a normal speed of 135 r.p.m. This engine is four-cycle six-cylinder, and directly reversible. The cylinders are 22 in. in diameter by 32 in. stroke.

The engine is of the enclosed frame type, and has air cooled trunk pistons. At the forward end of the frame is mounted the three stage compressor driven by an overhung crank on the forward end of the main crank shaft.

The cylinders are formed by a cast iron jacket into which are pressed liners which fit against a shoulder at the upper end, but are left free to move at the lower end to provide for expansion.

The cylinders have a heavy flange at the lower end for bolting to the frame, and are provided with studs at their upper ends for bolting on the cylinder heads.

The cylinder heads are very deep and are arranged for very thorough water circulation and are each fitted with intake valve, exhaust valve, fuel spray valve, air starting valve, safety valve, and relief valve.

The valves are operated by rocking levers which are actuated by push rods from the cam shaft. The latter is placed at the front of the engine just above the doors which give access to the crank pins.

The maneuvering gear is located just under the cam shaft at the forward end of the engine. The maneuvering is done mechanically by two rams which are actuated by the air pressure and controlled by oil dash pots. These rams actuate the rocker shaft which lifts the cam rollers off the cams, then moves the cam shaft endwise, putting another set of cams under the rolls, then puts the cam rollers back on the cams in their operating position.

The main fuel pumps, (there is one for each cylinder), are driven from a small shaft parallel to the main shaft. The stroke of these pumps and consequently the power and speed of the engine, are controlled by an operating lever at the forward end of the engine. This lever is interlocked with the maneuvering mechanism so that all the maneuvering has to be done in the proper sequence.

An auxiliary hand operating gear for maneuvering is provided, so that in case of any failure of the main ram, the maneuvering can be effected by hand though in a somewhat longer period.

During the test the power was absorbed by a Henan & Fronde Dynamometer. The fuel oil was furnished from a tank arranged on scales so that the exact weight could be taken. Thermometers were placed in the cooling water inlet and outlet, so that the difference in temperature could be noted, and while no attempt was made to use a minimum amount of lubricating oil, note was taken of such lubricating oil as was used.

To give the engine a thorough running trial, at as near operating conditions, as possible this engine was run continuously for thirty days at full load and rated speed. Although at times, due

to considerable variation in the city pressure the load on the brakes varied, in general, it was kept at the rated load over the whole period.

We are giving below a table showing the average results of the test showing the revolutions per minute, brake horsepower total fuel used in pounds per day, also the fuel per b.h.p. per hour for each day, of the complete thirty-day run :

Day	Av. R.P.M.	H.P.	Fuel Lbs.	Lbs. Fuel per B.H.P.H.
1	136.6	765	7764	.423
2	137.4	770	7574	.410
3	137.7	771	7584	.411
4	137.3	770	7630	.413
5	135.9	760	7702	.423
6	135.2	757	7474	.412
7	135.	756	7550	.416
8	135.1	756	7521	.414
9	135.5	758	7484	.412
10	137.1	768	7693	.417
11	135.8	760	7642	.418
12	135.5	758	7676	.422
13	136.9	767	7674	.417
14	137.7	771	7674	.409
15	136.4	764	7485	.408
16	136.4	764	7635	.416
17	136.3	764	7800	.426
18	134.4	764	7609	.415
19	135.5	765	7565	.413
20	135.5	765	7664	.417
21	134.6	755	7501	.414
22	135.1	756	7626	.420
23	136.7	765	7705	.419
24	137.1	768	7559	.410
25	136.3	764	7630	.416
26	135.4	758	7709	.423
27	134.9	756	7561	.417
28	134.9	756	7792	.428
29	135.9	760	7522	.412
30	136.6	765	7583	.413

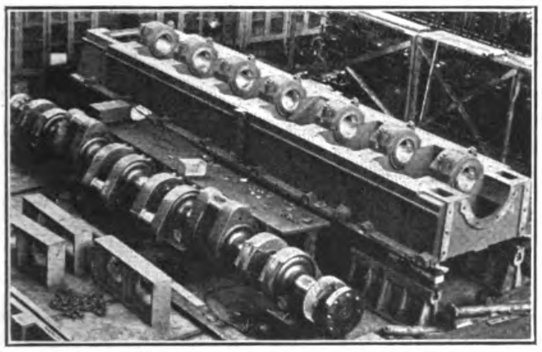


Fig. 1. Crankshaft and bedplate fitted with upper and lower bearing caps. The shaft is "built-up" and has a coupling in the centre

In looking at the above it will be noticed that the fuel economy was especially good, considering the conservative rating of the engine; that is, the low mean effective pressure on which the horse-power output was based. After the completion of the thirty-day test, some trials were run at reduced speed and the results at 125 r.p.m., 110 r.p.m., and 100 r.p.m. are given below.

ON HOUR TESTS

Time	Eng. R.P.M.	Lbs. Fuel Per 15 Min.	H.P.	Lbs. Fuel Per B.H.P.H.	Exhaust
1:48					
	128	63	565	.447	clear
2:03					
	120	59	530	.446	clear
2:18					
	123	60	543	.442	clear
2:33					
	123	57	543	.420	clear
2:48					
3:03					
	105	41	323	.507	clear
3:18					
	109	41	336	.488	clear
3:33					
	111	40	342	.468	clear
3:48					
	111	39	342	.456	clear
4:03					
4:18					
	91	36	280	.514	clear
4:33					
	98	36	302	.493	clear
4:48					
	102	38	314	.485	clear
5:03					
	99	37	304	.487	clear
5:18					

After the above tests were run, a trial was made to see how slow the engine could be run on its own spray air supply and this speed was found to be 100 revolutions per minute under the particular conditions for this test. Under other conditions a lower speed could be obtained and with an auxiliary spray air supply a still slower speed might be had.

When the above tests were finished, trials were made to determine the maneuvering qualities of the engine with the air contained in the maneuvering air receiver.

This maneuvering air receiver has a capacity of 250 cubic feet and is charged normally to a pressure of 325 pounds.

It was found that twenty maneuvers, that is ten starts ahead and ten starts astern could be made before the pressure got so low that the engine would not respond.

It was also found that the maneuvering gear would operate on a pressure as low as 121 pounds and that when maneuvered by hand the engine would start on 105 pound pressure.

The details of the above tests are given below.

MANEUVERING TEST
Capacity of Maneuvering Tank 250 Cu. Ft.
Pressure in Tank

Ahead	Astern	Second Required To Maneuver
352	...	...
...	338	28
322	...	14 2-5
...	310	19
298	...	15 1-5
...	278	16 2-5
270	...	15 2-5
...	255	17 3-5
245	...	17
...	235	18
225	...	18
...	212	16 3-5
202	...	17
...	193	17
182	...	17 2-5
...	170	15 4-5
162	...	24
...	150	19 1-5
140	...	18 1-5
...	130	23
121	...	25 1-5
...	111	1 min. 54 Sec. Hand
105	...	Reversing time not taken
...	98	Would not start at this pressure

There is the personal element entering into the time required for maneuvering.

It should not take over 16 seconds from full speed ahead to full speed in the reverse direction or vice versa.

The next trials were to determine the results of operation in the reverse direction. A test of 24 hours at full load and speed under the above conditions was made and the general results are given below.

Total fuel used in 24 hours	7,640 lbs.
Average r.p.m.	136
Load on the brake	2800 lbs.
Average b.h.p.	761.6
Fuel per b.h.p. hour	0.461

In regard to the above, it should be noted that final adjustment of the cams for rotation in the astern direction had not been made.

After all the above tests, the engine was dismantled for inspection.

No carbon was found on pistons or head and all piston rings were free in their grooves; the pistons showed good lubrication with no excess.

No scoring was found on any cylinders, pistons or valves. All valves and seats were found in first class condition.

All crankshaft bearings and connecting rod boxes were in perfect condition except a crack in the babbitt in number six crank pin box.

The fuel used during the test weiged 7.40 pounds per gallon and an average analysis showed 19,350 b.t.u.'s per pound.

The general arrangement of the engine is shown in the photograph page (41). The general view of the lower main bearings and crankshaft is given very clearly in photograph fig. (1).

While various tests mentioned above were being run, account was taken of the amount of lubricating oil fed each hour to the main bearings, crank pins, etc. This was shown to be twelve gallons.

This oil, however, is all caught in the base and returned through the filter and is used over and over again.

New oil is supplied for the mechanical cylinder lubricator which supplies oil to the main cylinders, piston pins, and the compressor. The oil from the piston pins, which gets into the base, is sufficient to make up all losses in that system.

A Market for Oil Engines

THE readers of "Motorship' are no doubt interested in the performance of the government owned wooden steamships built as a part of our emergency fleet to the order of the U. S. Shipping Board. Quite a few of these vessels have been sold and their actual operation within the next two years ought to furnish their owners valuable data for economic comparisons. The oil engine manufacturers should not lose sight of this potential market for their engines. Similar fleets powered with modern Diesel engines will unfortunately not be in operation on the same routes. Little can be said that would not be repetition concerning the cargo carrying possibilities of the two types. Briefly, the points of importance are as follows:

For equal power the Diesel engine saves weight; about one hundred tons per thousand horsepower. It saves space and it saves fuel; the latter factor affecting both cargo carrying capacity and operating costs. It also eliminates the fire room force, which reduces operating costs per ship and provides a valuable increase in the available seagoing labor market.

The Diesel engine is still rated higher than the steam plant in price for equal powers. This disadvantage disappears when the basis of cost is changed to that of cost per ton of dead-weight-carrying-capacity of the hull.

The United States Shipping Board has sold forty-one wooden steamers up to July 25th, 1919. The names of these vessels with other information follow. The first fifteen vessels will be operated by the Brook Steamship Co. of New York and will be placed in the Trans-Atlantic trade. Five of them, of 4,000 tons d.w.c. each are to be delivered in New York and ten of 4,700 tons. d.w.c. are to be delivered in New Orleans. Five will operate out of New York, five out of New Orleans, and five out of Havana. The reported selling price of the first fifteen boats was $650,000.00 each, or an average of $145.00 per deadweight ton.

Steamer	Purchaser	Date Sold	Date Delivered
Beechland	Nacirema SS Corp.	Mar. 16	April 16
Airlie	Nacirema SS Corp.	Mar. 16	June 23
Alderman	Nacirema SS Corp.	Mar. 16	
Argenta	Nacirema SS Corp.	Mar. 16	
Ashburn	Nacirema SS Corp.	Mar. 16	June 17
Birchleaf	Nacirema SS Corp.	Mar. 16	
Cowardin	Nacirema SS Corp.	Mar. 16	April 25
Dalana	Nacirema SS Corp.	Mar. 16	June 17
Horado	Nacirema SS Corp.	Mar. 16	May 20
Itompa	Nacirema SS Corp.	Mar. 16	
Natenna	Nacirema SS Corp.	Mar. 16	
Neabsco	Nacirema SS Corp.	Mar. 16	May 3
Nawitka	Nacirema SS Corp.	Mar. 16	June 9
Thala	Nacirema SS Corp.	Mar. 16	
Zavallo	Nacirema SS Corp.	Mar. 16	May 5
Yehama	Fidelity Trust Co.	May 5	May 15
Mazama	French American Line, Inc.	May 22	June 5
Itanca	French American Line, Inc.	May 22	
Coyote	French American Line, Inc.	May 22	
Red Cloud	French American Line, Inc.	May 17	May 23
Kanabec	French American Line, Inc.	May 29	
Clackamas	Nacirema SS Corp.	June 11	
Anoka	Nacirema SS Corp.	June 11	
Bell Brook	Nacirema SS Corp.	June 11	
Gresap	Nacirema SS Corp.	June 11	
Braeburn	Nacirema SS Corp.	June 11	
Braxton	Nacirema SS Corp.	June 11	
Brookwood	Nacirema SS Corp.	June 11	
Brentwood	Nacirema SS Corp.	June 11	
Bushong	Nacirema SS Corp.	June 11	
Butte	Nacirema SS Corp.	June 11	
Bushrod	Nacirema SS Corp.	June 11	
Buttonwood	Nacirema SS Corp.	June 11	
Byfield	Nacirema SS Corp.	June 11	
Mindoro	Nacirema SS Corp.	June 11	
Awensdaw	Nacirema SS Corp.	June 11	
Cartona	Nacierma SS Corp.	June 11	
Corone	Nacirema SS Corp.	June 11	
Dertona	Nacirema SS Corp.	June 11	
Deva	Nacirema SS Corp.	June 11	
Diana	Nacirema SS Corp.	June 11	

A cable has been received from a London agent announcing that a purchaser stands committed to take over twenty wood steamships of the Ferris type; that the prospective buyer has deposited funds in bank awaiting acceptance of his offer and that he has been given a 30 days' option on the purchase of an additional 100 ships. The cable asked authority to sign a contract for the sale of the twenty vessels and this authority has been cabled to him.

Under the terms of the sale the buyer agreed to pay ten per cent of the purchase price upon signing of the contract, and the balance upon delivery. Upon signing of the contract, the buyer will name his American agent who will represent him in the matter of deliveries.

All of the vessels to be sold in this group are of 3,500 deadweight tons, which is equivalent to 2,333 gross tons. The purchaser pays $300,000 for each vessel.

In the last group of this type of vessel sold by the Shipping Board were seven 4,500 deadweight ton vessels and five of 4,000 deadweight tons. They were sold at a flat rate of $450,000 each. * * *

There are now 174 wood steamships, of 614,116 deadweight tons, under operation by the Shipping Board. Most of these steamships are of 3,500 deadweight tons each. Three are of 4,000 and two of 4,929 tons each. Thirty-one are under charter and 143 assigned for operation.

BRITISH MOTORSHIP "ESNIA" SUNK

On July 21st., the British motorship "Esnia" sank after a collision with the Norwegian steamer "Snefjeld" in the river Seine. No lives were lost. The "Esnia" had been plying between a British port and Paris.

Interesting News and Notes from Everywhere

TWO NEW SCOTTISH MARINE ENGINES

A company has recently been formed entitled the Cummins Syndicate, Ltd., having registered offices at 224 St. Vincent Street, Glasgow, with the object of placing on the market at an early date a low-pressure Diesel engine built on very novel lines. We have seen the drawings, and from them conclude that many outsanding obstacles have been overcome. We hope shortly to publish details of the testing of the first model.

The Mercantile Engineers and Foundries, Ltd., of 104 Harmony Row, Govan, Glasgow, are about to put on the market a four-stroke two, three, and four-cylinder motor with overhead valves, containing many new features, particularly in connection with the design of the crankcase, in which they have aimed at the saving of machining of parts, and the reduction of time expended on assembling. The other novel points we hope to refer to in an early issue, as soon as all preliminary tests have been concluded.

ROYAL DUTCH PETROLEUM COMPANY

The increase in oil production and refining in the past few years together with the enormous increase anticipated in the future is reflected in the additional authorized capital stock of the Royal Dutch Petroleum Co. The common stock during 1919 has been increased from $48,240,000 to $80,-400,000. The fleet of tankships operated by the subsidiary companies amounted to 263,746 tons on December 31, 1918.

MAKER OF ENGINE PARTS OPENS OFFICE

The Camden Forge Company, Camden, N J. has established a New York District Sales Office at No. 2 Rector St., New York City, with Mr. Samuel W. Hilt as Manager.

MOTORSHIPS ARE THE FOUNDATION OF PROSPERITY

In a recent conference of the Seattle Foreign Trade Club, the future of the wooden shipbuilding industry and its connection with the growth of business on the Pacific Coast was earnestly discussed.

The raw materials produced on the west coast can only be marketed by means of cheap transportation as the bulk of the trade is in low-class, low-priced commodities. The supply of lumber, the largest and most valuable raw product coming from the west coast, is unlimited and the demand for it is greater than ever. It has been determined after long study, that lumber can be shipped via water to the Atlantic Coast at $8.00 per 1,000 bd. ft. at a profit. Canned salmon carried from this territory to New York at $5.00 a ton and a return cargo of pig iron pay $4.00 a ton would make money for the ship-owner. In comparison with these rates the cost of transporting lumber by rail to New York City is $26.40 per M. bd. ft. The ideal way of making shipments by water was determined to be by wooden vessels, equipped with an auxiliary oil-burning engine. These ships should have a capacity of 3,000,000 ft. of lumber or 3,500 tons, and carry a crew of 20 men. The earnings would be $24,000 or about $1,200 per day for a 20 day trip to the East Coast. A crew of 20 men would cost $200 per day, leaving $1,000 for interest, depreciation, upkeep and profits.

The lower cost of these western products would be a welcome relief in the East in these times of soaring prices.

TEAK HULL MOTORSHIP BUILT IN BOMBAY

A 115 foot motorship of 170 tons displacement has been built in India for cargo carrying. The vessel constructed wholly of teak has a breadth of 14 ft., depth of 8 ft. 3 in. and a draught of 7 ft. The power plant is a "Speedway" paraffin engine provided with an extra carburetter for gasoline starting. The valve gear is actuated by three separate cam-shafts, one on the port side for the starting air valves, while on the starboard side of the engine are two separate shafts one for the inlet and the other for the exhaust valves. All cam-shafts are moved fore and aft for changing direction of running. The power is 150 b.h.p. at 550 r.p.m.

It is interesting to note that an 800 ton schooner was recently built in India, in which we learn the owner was obliged, much against his own good judgment, to install steam engines due to the fact that no internal-combustion engines could be obtained. Several other vessels of the same size, however, are nearing completion in which oil-engines will be used exclusively.

DIESEL ENGINE USERS' ASSOCIATION OF ENGLAND, JUNE MEETING

A short paper on "A Method of Checking the Alignment of Diesel Engine Shafts, and a Means of Proving if a Shaft is actually Bedding in its Bearings" was read before the Association by Mr. Geo. E. Windelor.

No originality was claimed for the system, but it was stated that if known, to others, there had been little practical use made of the principles. With the use of a suitable instrument, designed by the author, any engine operator could be instructed in the practical application of the system.

It was explained that end movement of a shaft in excess of the actual mechanical clearance allowed, was an indication that springing of the crankshaft was taking place for want of proper support, and that actually the shaft was being extended and contracted in length by the opening and closing of the gap between the crank webs. A measure of this distortion was taken by measuring with a suitable instrument the distance between the crank webs when the crank pin was on the top centre and when it was on the bottom centre. A few thousandths of an inch difference in these two measurements indicated that the shaft was out of line. The method was especially valuable when checking the alignment of outboard bearings. The instrument used was exhibited at the meeting. The method enabled a check to be taken at any time as to whether a shaft was properly supported or otherwise, without removing any parts. The method is also valuable when rebedding a new bearing into position, as it enables the refit to take place without removing other parts from the engine, and with a certainty that every bearing will be accurately in line.

MORE INTEREST SHOWN IN THE MOTOR SCHOONER

Financial interests in the East are developing connections wherewith they plan to build wooden auxiliary schooners of about 1500-1600 tons carrying capacity powered with Diesel engines of about 450 H.P. A design will also be developed for 700 ton schooners with about 350 H.P. installed in them for auxiliary purposes. Tams, Lemoine and Crane, Naval Architects of New York City, will design the boats.

DIESEL ENGINES ON THE GREAT LAKES

In further references to our article published in the August issue of "Motorship" we are very pleased to note that one of the larger steel corporations have under construction a large modern ore carrier to be equipped with Diesel engines.

This vessel is substantially a duplicate of others which they operate.

Most interesting comparative data should result from this installation in service as two of the sister ships are powered with steam turbines and reduction gears and a third with reciprocating engines.

STEAMSHIP OWNERS PLEASE NOTE

The largest vessel built in Australia—a collier of 10,000 tons loaded-displacement,—has been launched at the Cockatoo Island Shipyard, Sydney, N. S. W., for the Broken Hill Proprietory Co., Ltd. of that city. We mention this in our columns for the benefit of the above owners and other shipowners as we note that of the above tonnage no fewer than 1,730 tons is represented by oil-fuel (1,068 tons) and water (662 tons) respectively.

Had Diesel engines been installed instead of oil-fired machinery 500 tons of fuel would have been sufficient for a voyage of about 8,000 sea miles at 11 knots and not more than 50 tons of fresh water would be required and there would be about 150 tons saved in the machinery weights. In other words, had she been a motorship her cargo capacity would be at least 1,330 tons greater. This extra cargo-capacity means real money. Figure it out at $30.00 per ton per one-way trip, with 5 round voyages per year, and with the ship burning only 8 tons of fuel per 24 hr. day, and no stokers to pay.

We figure it at $390,000.00 per annum additional income from the 1,330 tons of cargo, apart from the lower fuel and operating costs; or, say, a total of nearly half-a-million per year.

A MOTORSHIP DE LUXE

The Danish motorship "Fionia" has 42 beautifully equipped passenger-cabins all with private bath-rooms. Her best speed is 14 knots and she carries a large cargo. Since she was placed in service she has covered several hundred thousand miles.

SMALL SKANDIA-ENGINED MOTORSHIP

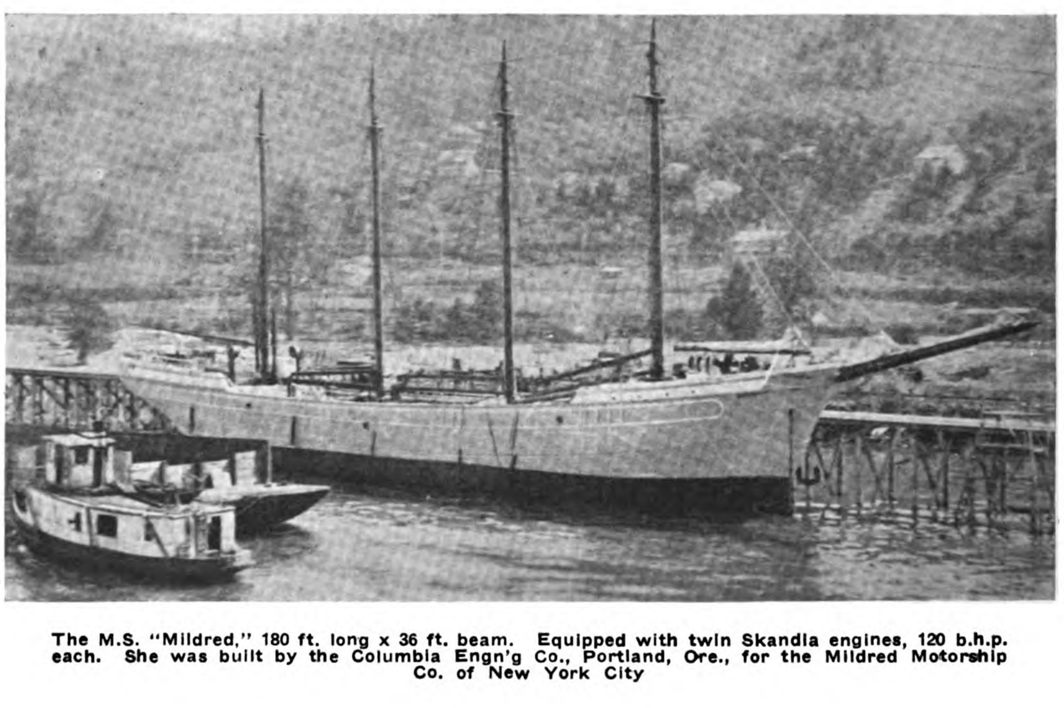
A Skandia oil-engine has been installed in the new 250 tons displacement motorship "Edith", recently completed at the Kalundborg Shipyard, Kalundborg, Denmark. A speed of 7¼ knots was attained. She is owned by the Forde Co.

MOTOR DRIVEN DECK MACHINERY

Messrs. Gulowsen Grei have produced a line of motor winches for cargo and fishing vessels. These machines are of 3½ b.h.p., 7 b.h.p, and 16 b.h.p. with lifting capacities of from 1,500 lbs. to 2 tons. These winches may be driven by friction clutches or directly driven by a chain drive. An interesting model is a double drum winch connected to a single Grei engine by a chain drive. The drums are quite independent of each other and the motor has sufficient power to operate them simultaneously under full load.

NEW CORPORATION TO BUILD AND OPERATE MOTORSHIPS

The Cramp Shipbuilding Co., of Philadelphia has been combined with the Kerr Steamship Co. to form a large corporation to be known as the American Ship and Commerce Corporation. It is believed that the new corporation will operate motorships, constructed in the Philadelphia yard. The capital stock of the new organization will be about $46,000,000.



The M.S. "Mildred," 180 ft. long x 36 ft. beam. Equipped with twin Skandia engines, 120 b.h.p. each. She was built by the Columbia Engn'g Co., Portland, Ore., for the Mildred Motorship Co. of New York City

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial Endorsement of opinions expressed.)

VIEWPOINT OF A BRITISH ENGINEER

To the Editor of "Motorship,"
Sir:

Kindly allow me to congratulate you upon the excellence of your journal, the first copy of which I received this month, and found most interesting and instructive; I regret that I have not subscribed previously.

The importance of a technical journal devoted to this latest development of Engineering Science cannot be overestimated, and I shall endeavor to recommend "Motorship" to as many of my friends over here as I can, as there is no publication over here catering entirely to the marine Diesel Engine user.

Yours very truly,
GEORGE L. KIRK.

Norton Hall,
Stockton-on-Tees,
Durham, England.

BEARING-PRESSURES OF THE WEISS ENGINE

To the Editor of "Motorship:"
Sir:

In your issue of October 1918, page 21, column 3, bearing pressures are discussed and the term "projected area" frequently used, whereas in my opinion the figures stated are for cross sectional areas, which no doubt is the better method, but should somebody compare pressures like I did and used projected area, figures are confusing and no comparison is really made. Perhaps I have taken this up wrongly, or it may be a typographical error.

Yours very truly,
G. B. MURDIE.

1015 Queens Ave.
Victoria, B. C.

FOREIGN DEVELOPMENTS

To the Editor of "Motorship":
Sir:

Let me say at this opportunity that I am much pleased with the policy of "Motorship" in giving serviceable descriptions of the many schemes used in the arrangements of the various prominent foreign Diesel engines. It is a big help in keeping one in touch with modern developments. However, it is my hope that you plan to give your readers an idea of the developments that have taken place in Germany during the war, as soon as possible.

Yours very truly,
A. H. LACEY.

704 Calmar Ave., Oakland, Calif.

[We expect to leave for a trip to Europe sometime this month, and hope to secure much information of value and interest to our readers.—*Editor.*]

To the Editor of "Motorship."
Sir:

Thanking you very much for sending me a copy of your "War and Peace Commemorative Supplement." It is exceedingly interesting and I am very glad to have it.

Yours very truly,
FRANKLIN D. ROOSEVELT.

Navy Department,
Assistant Secretary's Office,
Washington, D. C.

LUBRICATION TROUBLE IN HIGH POWERED GASOLINE ENGINES

To the Editor of "Motorship"
Sir:—

During the writer's extensive experience with internal-combustion engines of various types, including hot bulb, Diesel, and gasoline engines, most annoying troubles have been experiencd with lubricating systems. The engines may have been otherwise well designed, but were heavily handicapped in delivering continuous power until the problem of lubrication, as to the quantity and quality of oil supplied under service conditions, was solved by the operator.

The writer has been in charge of the engines in one of our 110 ft. submarine chasers. These boats were powered with three 250 h.p. six-cylinder direct-reversing gasoline motors, developing their rated power at 460 r.p.m. I have seen them run at 550 r.p.m. for long periods without giving trouble, but only when the right oil, in the right amount, and at the proper temperature was supplied to all the bearings.

The oil recommended for these engines was the Standard Oil Co.'s "Mobil B." This is a fairly thick oil and gave good results in warm weather. However, the oil furnished for lubrication was changed, and we were supplied with three grades of the Texas Co.'s oil. They were, Pinnacle oil, a very heavy black oil; Ursa oil, a light bodied oil; and another still lighter oil which was used only for the auxiliary electric-light engine.

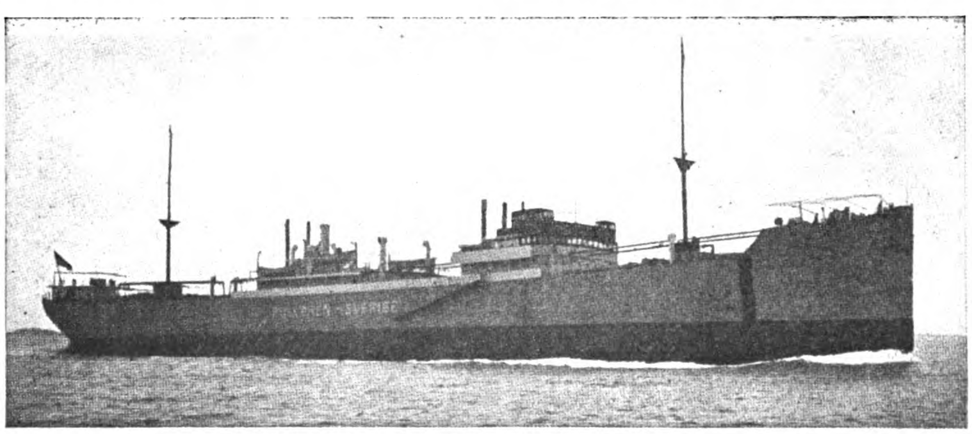
The lubricating system on the engines was as follows: The mechanical oilers were mounted on the port side of each engine at the forward end. The supply pipes to the cylinders led to a nozzle with a fixed opening, the pin of which was removable. The oil then passed through a ball-check valve, before entering the cylinders. Considerable difficulty was experienced in keeping this part of the system clean, as any dirt in the oil was sure to block the delivery pipe at the nozzle. This was overcome by drilling the nozzles larger, thus allowing any foreign matter to pass. No further trouble was experienced with this part of the outfit. Other pipes from the lubricator supplied the main-bearings, connecting-rod bearings, etc. Each pipe branched out into three other smaller lines, which were fitted with sight feed drips. One of these branches supplied a connecting-rod bearing by means of a banjo-ring and the other two pipes led to a main-bearing.

When heavy oil was used these sight feed drips had to be adjusted very often in order to keep them working properly. The writer's custom was to open them right up about every thirty minutes for a minute or so and then close down on them. This allowed any congealed oil to pass. By removing the adjustment screw a wire could be run through the sight feeds to clean them. I have seen many a hot bearing on other boats occur because these delivery pipes became choked at some point.

When using Pinnacle oil in the oilers at zero temperature a good deal of trouble was experienced (with the "U" shaped pieces which actuated the pumps of the oilers becoming bent. This would put them out of action temporarily. Also, after the engines had lain idle for a few days, a blow torch had to be applied to the pipes before the oil would run. It might be noted that the lubricator was never intended to pump an oil as heavy as the Texaco "Pinnacle." It was finally discovered that a combination of 60% Ursa oil and 40% Pinnacle oil gave a mixture that would run fairly well in cold weather. It also had the right consistency to properly lubricate the bearings of these fast running engines. With this combination we made long runs of several days duration without experiencing a hot bearing.

The makers of mechanical oilers should bear in mind that consideration of the extremes to be met in service conditions will repay them in added reliability of the entire engine.

Yours very truly,
GEORGE NICHOLSON, M.E.



M.S. "Bullaren" 9500 tons d.w. Arrived in New Orleans July 25th last from Copenhagen in ballast

To the Editor of "Motorship."
Sir:

I would like to mention a little mistake in your May issue on page 19 re "Fuel Consumption Comparison," which seems to have been twisted around, and which I have not so far seen corrected. [The figures referred to should read:

Diesel engines	260 tons
Steam engines (oil fired)	800 tons
Steam engines (coal-burning)	1,600 tons

Editor.]

In the July issue under the heading "Raft Ship with Auxiliary Oil Engines," you mention a lumber raft to be built by Vickers in British Columbia. I have seen similar notices in British illustrated papers accrediting the same to Vickers, Ltd. I might state on good authority that these demountable ships were not designed by Vickers, but by Pacific Coat lumber interests.

The plans were reviewed by Vickers, who, after considerable re-designing came back to the inventor's original design. The 6 ft. model which I saw in Victoria looked like an eminently practical idea with the exception that the engines and fuel tanks were mounted on top of the raft. This seemed to look top-heavy to me, but the designers claim the machinery weights will be negligible as compared with the great weight of five to seven million feet of saturated lumber.

I trust you will not think I am starting a "clean-up" campaign on "Motorship" but rather that I look forward to may monthly copy with eager anticipation. As a practical engineer and designer I think "Motorship" A-1.

Yours very truly,
G. B. MURDIE.

1015 Queens Ave.,
Victoria, B. C.

NEARLY FOUR THOUSAND FIVE HUNDRED MOTOR VESSELS IN JAPAN

To the Editor of "Motorship."
Sir:

According to communication from the Mercantile Marine Bureau of the Japanese Government, there were on January 1st no fewer than 690 motor-driven vessels, including auxiliaries ranging from 20 to 1,000 tons gross in Japan. Included in this number are about 150 fishing boats. Furthermore, there are about 2,800 motor craft ranging from 5 to 20 tons gross.

Yours very truly,
Mercantile Marine Bureau
Per M. Tsutsumi.
For Director.

Department of Communications,
Tokyo, Japan. April 29th, 1919.

STATEMENT OF CHAIRMAN OF HOUSE COMMITTEE ON MERCHANT MARINE AND FISHERIES

To the Editor of "Motorship."
Sir:

I am in receipt of your letter of the 1st instant, also copy of "Motorship" which I have read with interest and thank you.

It is my opinion that the future successful competitive operation of ships is intimately connected with the development of the internal combustion engine.

I have no doubt that the inventive genius of the American Nation will before long, if it has not already done so, produce engines of this character which will successfully pass every test, for any size of vessel and in doing so will solve many of the problems of the shipowner.

Very truly yours,
GEORGE W. EDMONDS.

House of Representatives,
U. S. Committee on
The Merchant Marine and Fisheries,
Washington, D. C.

Practical Operation of Marine Diesel Engines

By K. CARLSEN

THE popular objection to the Diesel engine for marine propulsion is that the men necessary for their reliable operation are of a high grade, and consequently, are difficult to obtain. It is acknowledged to be poor policy to place a steam engineer in charge of the machinery of a motorship without a preliminary shop course and some erecting and testing experience. To cover the ground briefly, the difficulty does not arise from the complications in the machinery, but from the necessity to have every detail of each working cylinder in proper adjustment. True, the adjustments must be finer and more exact than for steam, but there is considerable simplicity obtained by the fact that the pistons, rings, valves, valve gear and cams are all alike for each cylinder.

It is exceedingly simple to operate a Diesel engine when it is in correct adjustment, and almost every engineer prefers the Diesel engine to steam machinery after being able to make comparisons from personal experiences.

The dependability and cost of maintenance of a Diesel engine depends, as with steam machinery, on the care and "engineering sense" of the personnel. The engines should be kept in the best possible working condition and any defect remedied immediately.

[Before going further it may be remarked that the problems of ordinary engine room routine work whether on steam or Diesel engines are really those of diagnosis of symptoms which may come to the attention of the watch officer through his five senses. Troubles are nearly always noticed either from the the feel or the sound of some part working improperly. Sometimes that so called sixth sense will detect trouble before it really arrives.—Editor]

Starting

If any repairs or adjustments have been made previous to the time of starting, the engine should be turned over by hand or by the turning engine. All moving parts should be clear of everything and all valve timing and maneuvering gear should be checked for correct operation. All lock nuts and split joints should be drawn up tight. Valve spindles should all work easily, but without leaks. The lubricating oil tanks and fuel oil settling tanks should be measured or otherwise tested. The condition of these tanks must be known for clean lubricating oil and fuel is essential to reliable operation. The operator should give the inlet and exhaust valve stems a little kerosene. He should be sure that all overflow valves in the fuel line and also the indicator cocks are closed. To test the fuel line and to insure reliable fuel injection after starting on air, proceed as follows: Test the fuel line for leaks by opening it up to the high pressure air in the spray air bottles. Then close the fuel line to the injection air. Open the drain valves to let out all air pressure and immediately close them again. At least 800 lbs. pressure should show on the gauges for the spray air bottles and a good supply of starting air should be available.

Different designers use different pressure and amounts of starting air, but few engines of the full Diesel high-compression type will start when cold on much less than 150 lbs. of air.

All lubricating devices should be filled with oil and regulated for proper feeding. The oil pumps for forced lubrication should be started if separate from the main engine. If necessary, the cranks should be placed in the proper position for a positive start. The inlet valve, if any, on the low pressure side of the air compressor, should be opened wide, together with all drains from the inter-coolers.

[Evidently the writer means that the throttle valve in the first-stage suction of the air-compressor should be wide open—Editor]

If the temperature of the cooling water is very low, do not let it run through the cylinder in a full stream or for any length of time before starting. The cylinder might be cooled to such an extent that it will be difficult if not impossible to start the engine. All valves on the fuel supply line to the fuel pump should be opened wide. Adjust the fuel pumps to work by hand and pump oil into all fuel lines till it appears in a solid stream from the overflow valves. Then stop pumping, close all overflow valves and put the hand pumping gear out of action. Open the valve between the H.P. compressor and the air bottle and the engine is ready to start.

After the engine is started, open the cooling water discharge from the circulating pump to the running position and close all the drains from the inter-coolers. Fill all air tanks to the right pressure as soon as possible and examine the engine all over to be sure everything is working properly. [Of course, anything that has been adjusted since the last run will be carefully watched for a time—Editor]. If the pistons are water cooled, inspect this system and ascertain the volume and temperature of the cooling water discharge. All cooling or circulating systems should be started before or at the same time as the engine. Everything proving all right, the engine may be stopped and it will be in readiness for immediate service.

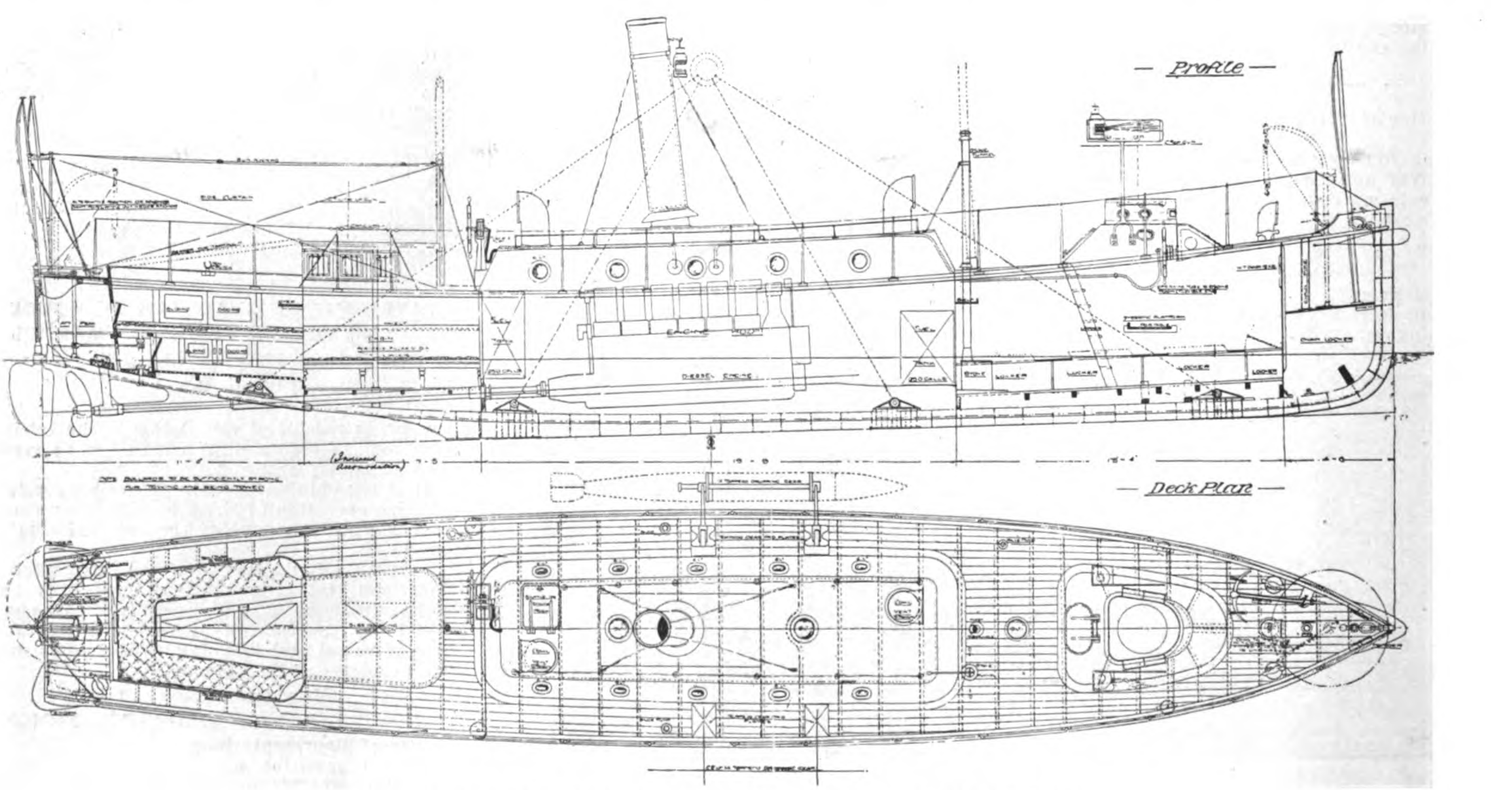
If compressed air is not available, compressed carbonic acid may be used to fill up the bottles, but under no circumstances may oxygen, hydrogen or any other gasses be used. In filling a bottle with carbonic acid gas all valves should be closed, while the carbonic acid tank is connected to the air bottles. Open the valve between the two tanks. The pressure in a carbonic acid tank is usually about 750 lbs. per sq. in. and when the pressure has dropped to about 300 lbs. close the valve and slowly pour hot water on rags laying around the top of the carbonic acid tank. When the pressure has returned to about 750 lbs. open the valve to the air tank again. Repeat this until all the acid is evaporated or until the required pressure in the tank is obtained. After the engine is started immediately fill all tanks with air and drain out the rest of the carbonic acid. If the injection air tank has been filled in this way, the exhaust valves should be cleaned as soon as possible.

While Running

The most important things to watch while running are the different gauges. These will often show where to look for trouble if there is anything wrong. The engine should run evenly without smoking or knocking. Care should be taken to see that the cooling water circulates properly through all parts requiring it. Small cocks are generally fitted in the cylinder heads to let air out of the cooling spaces and thus avoid air pockets which prevent proper cooling. Thermometers are furnished at different places where a constant check on the temperature is necessary. The temperature of the cooling water at the outlet should not be so hot that it can not be felt by hand. 160° Fahr. is a maximum. The lubricating and fuel oil filters should be cleaned at frequent and regular intervals. The different stages of the air-compressor should each do an equal part of the work in compressing to the highest pressure. If the pressure in the forced lubrication system drops it is usually on account of dirt in the filter. The daily supply tank should be drained frequently because excess water in the fuel oil will stop the engine. There are generally two supply tanks. As soon as one is empty, the other may be connected to the pump suctions and the first filled up immediately. Any water in the fuel will thus have time to settle down, and be drained off. Air bottles should be drained of condensed water and there should be two drain valves; the one next to the bottle should be fully opened and the other just cracked open a little to let the water out.

Draining water through a valve opened very slightly and with two valves in the drain pipes, the first may be closed tight and the second taken off and ground when necessary.

Always be sure that the water or oil circulates properly if the pistons are cooled. If the oil circulation is not sufficient the oil will carbonize, resulting in the piston heating and the rings stick-



50 ft. Motor Pinnace built and engined by Messrs J. Samuel White & Co., Ltd.

ing. Press fingers on all valve rollers and if the clearances are correct, they can be prevented from revolving for the period during which the cam is not under the roller. [In some designs of valve gear the valve roller is intended to roll on the cam at all times.—Editor]

After the engine is stopped, close all valves on the fuel supply line. The cooling water should be gradually reduced and not stopped until the engine has cooled down sufficiently to prevent the lubricating oil from drying on the cylinder walls. In a cold climate, if there is danger of the water freezing, all jackets and pipes should be drained. All lubricators should be turned off and the force feed lubricating pump stopped. All valves to the air injection and starting tanks should be closed tight, and the air blown out from the injection line and compressor. None of the gauges should show any pressure.

Will Not Start

If, when starting the engine, combustion does not take place it can not be forced by prolonged operation on air. The only result will be loss of valuable starting air. The difficulty is generally due to one of the following reasons.

I. No fuel.
   a. The fuel valve from the daily supply tank may be closed.
   b. Daily service tank may be empty.
   c. There may be air pockets in the fuel supply line or in the fuel pump. This might happen if the supply tanks were not high enough above the suction valve of the fuel pump. In this case, take off plug above the pump's delivery valve, after closing the valve to the supply tanks, then open this slowly and let the oil run out until no air bubbles escape from the outlet. Then fill up the line to the fuel oil valves in the usual way.
   d. Fuel may be leaking past the fuel pump pistons.
   e. The line between the pump and the fuel valves may be empty, either on account of improper filling of the line, or from leakage it too long a time has elapsed before starting after the line is filled.
   f. The hand pump may be loose.
   g. Sometimes the engine will not start if the atmosphere is at a very low temperature. It may then be necessary to fill the water jacket with steam or heated water.
   h. At such low temperature the fuel oil may be too thick to run. Therefore, ships that have to go to cold climates should have arrangements provided for heating the fuel oil.

II. Low compression. The temperature may then be too low for ignition.
   a. The slots in the inlet pipes may be filled with dirt.
   b. Compression may leak past the valve housing and valve seats.
   c. The striking joint may be too big.

The various troubles that may develop in the running of the engine may be classified by their symptoms. In fact, the same result may be caused by totally different defects and it is the test of a good engineer to find the true cause promptly.

I. Motor knocks while running.
   a. A loose bearing. The knock may cease if the bearing is flooded with heavy oil.
   b. Too early injection. This may cause slight explosions instead of proper combustion and is to be remedied by the proper adjustment of the fuel gear.
   c. Too late injection.
   d. Too high or too low injection air pressure.
   e. The fuel valve may be leaking badly, and in that case the engine should be stopped immediately. Under this circumstance the fuel is getting in the cylinders too early and there may be ignition before the piston is at its top centre.
   f. Improper pulverising on account of dirt in pulverizer. Raising the pressure of injection air for a short time may remove the dirt.
   g. Improper distribution of fuel to the different cylinders.

II If the engine is working correctly the exhaust gases will be nearly invisible. If the exhaust gases are smoky or black, this will be due to following causes:
   a. Too low injection air pressure.
   b. The fuel valve is not lifting high enough. This can be remedied by raising the injection air pressure. [Or reducing the clearances in the valve gear.—Editor]
   c. Leaking fuel valve. The valve may stick or need grinding. It may be on account of improper adjustment, which would prevent the valve from closing properly. In this case it is difficult to keep the injection pressure, because the air is continually leaking into the cylinder. This should be remedied immediately.
   d. If overloaded, the engine will smoke. This is not necessarily due to faulty operating. If the overloading of the engine will be necessary for some time, raising the pressure of the injection air, or a slightly earlier injection will lessen this trouble.
   e. The pulverizer may be dirty.
   f. A hot bearing will overload the engine and make it smoke; careful investigation may locate this trouble and increased lubrication overcome it.
   g. Resistance against the inlet air. The slots in the inlet pipes may be partly closed with dirt and must be cleaned.
   h. Resistance against the exhaust gases. The exhaust pipe is dirty or there is water in it.
   i. The compression is too low.

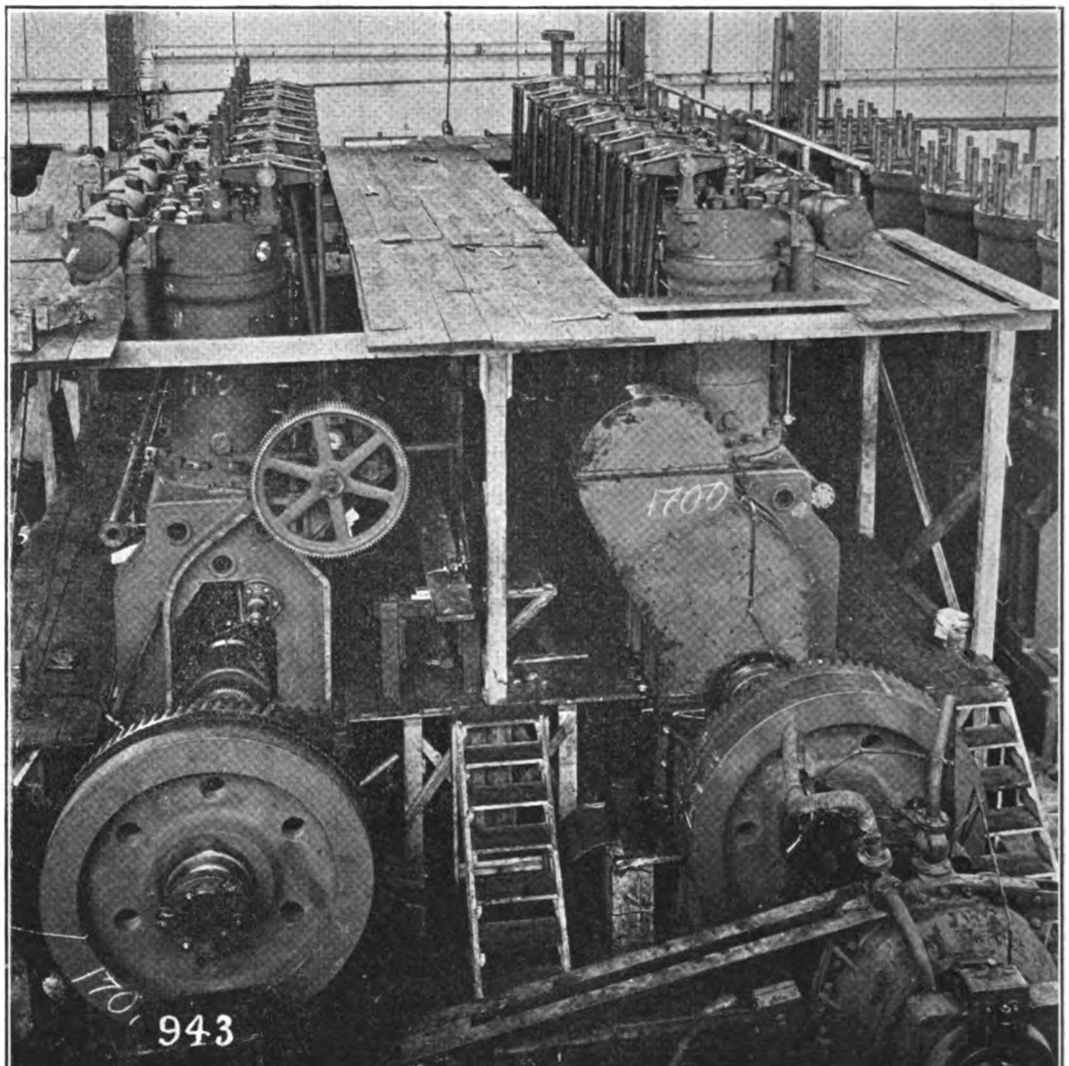
III. Uneven Running
   a. The governor connections are not working freely; it should be re-adjusted.
   b. The air compressor pistons may be leaking, or the automatic valves are leaking, sticking, or not seating properly. In this case, the air injection pressure might vary.
   c. The fuel pump is working irregularly on account of dirt in valves or leaky stuffing boxes, or it may be working too fast on account of improper adjustment.
   d. Sometimes each cylinder is not doing an equal share of work. This will be easily found by taking indicator cards, and is usually on account of improper distribution of the fuel oil.
   e. If, when opening the test holes in the exhaust pipe, the exhaust is not uniform in color and sound, the improperly working cylinder should be examined with regard to valves and their adjustment corrected.
   f. Water in the fuel will make uneven running, if it does not stop the engine.

IV. If the air pressure cannot be maintained, the engine is using too much or the compressor is not delivering enough.
   a. Count the r.p.m. for if the engine is running slowly it uses more air because the fuel valve is open a longer time.
   b. If the engine is running at the proper speed it might be using too much air because the play between the cam and roller is too small. The lifting of the valve would then be too great.
   c. The fuel valve may stick or leak. Stop immediately and fix it.

The compressor may not be delivering enough air for following reasons:
   d. The intake pipe, if any, on the compressor's low pressure side, is plugged up with dirt, or the valve is not fully open.
   e. The valves are leaking or sticking. This can be determined by laying the ear on the compressor close to the valve cages.
   f. The striking joint may be too big.
   g. Leaky or sticking piston rings.
   h. Leakage of air to cooling water.
   i. Leakage of air at the forced feed lubricator.
   j. Leaks in pipes, valves or connections. These last can be distinguished by a whistling sound.

If there is oil in the cylinder before starting it should be taken out. There can of course be no more oil burned than that which will use up the air in the cylinder and for that reason the pressure resulting from an overcharge of oil will hardly ever exceed 1500 lbs. per sq. in. This is usually a safe pressure for the working cylinders. However, the ignition and consequent combustion may occur early in the compression stroke and further compression result in excessive pressures. Usually this results in blowing through the cylinder head gasket or down past the rings. This is only likely to occur on starting when the accelerating forces are high due to the starting air pressures and the extra heavy charges of fuel from the primed valves. Always close the valves in the fuel line to the injection valves upon stopping for a reasonable length of time.

The above seems to be just a long list of errors and rules, but on looking them over it will be seen that they embrace nearly the same remedies over and over again. These remedies are very simple and quickly applied, the principal source of trouble being the timing, adjustments, and tightness of the valves. The proper working of the fuel valve is most important.



The first pair of 960 I.h.p. Diesel Engines for the U. S. Emergency Fleet Corpn. The report of 30 day test run of No. 1700 seen on the right is published elsewhere in this issue

An Extensive Repair Job At Sea

By H. W. SCHRECK, M. E.

(Translated)

THE single screw motorship "Lidvard" ex. "Pangan", now belonging to the Norwegian Government, had an accident on the 11th of September, 1916, when the crankshaft at the after cylinder broke. The vessel was about 1,500 miles west of Sumatra, loaded with sugar, on a voyage from Samarang, Java, to Marseille, France.

She was built on the Clyde and her motor constructed by the Burmeister & Wain Diesel Motor Co., of Glasgow. At the time the accident happened the vessel belonged to the East Asiatic Co., of Copenhagen, Denmark. The engine room staff under the guidance of its chief engineer, Mr. Syllings, started at once to repair the damage at sea. At first a number of ¾" thick steel plates were cut out of some watertight doors in the bulkhead and an attempt was made to strengthen the crank web by fastening several layers of these steel plates as is shown on the accompanying sketch. However, this re-enforcement was not sufficient, and it was then decided to drill a hole through the broken crank web and bolt same together. The break is shown by the sketch and is located, as is very often the case of a broken crankshaft, at the junction of the crank web and the shaft.

The total engine room crew consisted of nine men, one of whom was sick. These eight men worked in 8-hour shifts for eight days and nights, boring a 3" hole which was about 38" long. There was no reserve crankshaft on board and only two drilling machines. One of these machines was worn out when the job was finished. First there was a 1" diameter hole drilled all the way through, then this was rebored to 2" in diameter and finally to 3" in diameter. The steel plates on the side of the crank arm were fastened with 1⅛" and 2" tap screws as the sketch shows. The 3" bolt was first made of a heavy boomfitting. The material, however, was not very good as was immediately apparent when it was machined. As was expected, the bolt did not stand the test and it had to be driven out again. Then a piece was cut out of one of the boat davits and turned down to 3" diameter. This piece proved to be good material, and the bolt was driven in and set tight with a nut. A piece of hardwood was placed between the webs and the steel plates, and the whole was held together by two 2" through bolts, as is shown in the sketch.

Altogether it required 37 days and nights to do the work and during this time the vessel was driving about in a circle, the radius of which constantly increased. During one day and night alone the vessel drifted 90 miles and when repairs were at last completed, the captain found that the vessel was not very far from land. The motor was successfully started by using a kind of microphone from the after crankshaft housing to the operating platform. The revolutions being ordinarily 105 per minute were reduced to 70 per min.

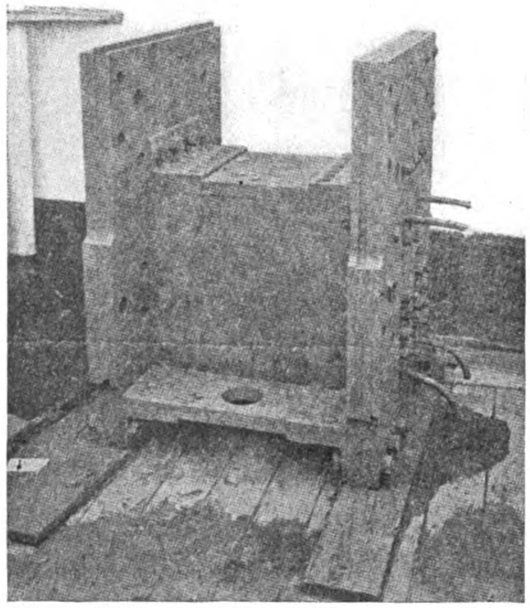
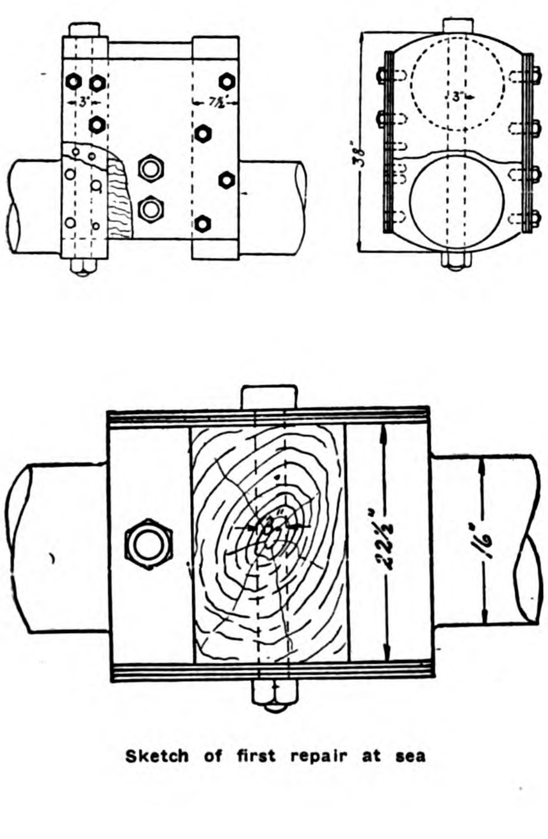


Fig. 1. Temporary fitting made of plates and angles installed on crankshaft of M.S. "Pangan" at Emmahaven, Sumatra

While the vessel drifted about in the Indian Ocean she was once observed by an English transport, which sent notice to shore, and again by a Dutch steamer which offered to tow the vessel to a port nearby. There not being any repair facilities at that place, the offer was refused. No wireless equipment was provided on board. The weather held fair and after the repair was finished on the 12th of October, a course was set for Sumatra which was reached after three days and nights of sailing, and on the 15th of October the ship arrived at Emmahaven.

The temporary repair work which had been done at sea and had proved satisfactory, was here replaced by a more solid construction. This work was done at a local repair shop and the new fitting is shown in Fig. 1, lying on the deck of the vessel. On Dec. 3 the vessel left Emmahaven for Colombo where everything was found to be still in good shape. On the 6th of January, 1917, the vessel arrived at Port Said after a voyage of 4,700 miles, the engine turning about 75 revs. per minute. At that time the Mediterranean was blockaded. The cargo was therefore discharged and a new cargo of salt loaded for Singapore. About the 10th of July the vessel left Port Said and arrived at Singapore on the 17th of August. All this time the same repair fitting had stayed on the shaft and a distance of about 5,100 miles had been covered with it.

At Singapore a steel casting sent by Burmeister & Wain was fitted and is shown assembled in Figs. 2 and 3. Then the vessel left by the way of Shanghai and Kobe for San Francisco where she was sold to the Norwegian Government. She then went through the Panama Canal to New York, covering a total distance of 13,800 miles.



Sketch of first repair at sea

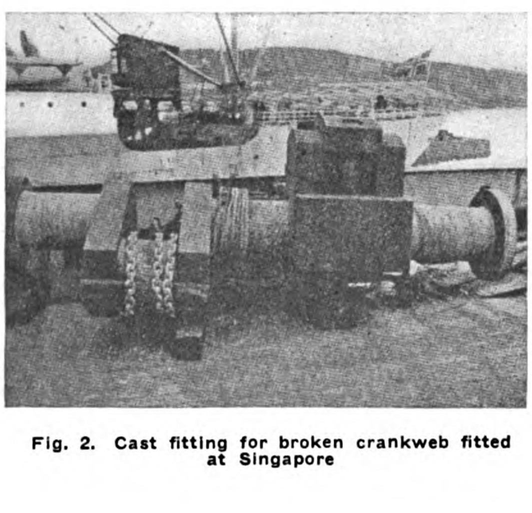


Fig. 2. Cast fitting for broken crankweb fitted at Singapore

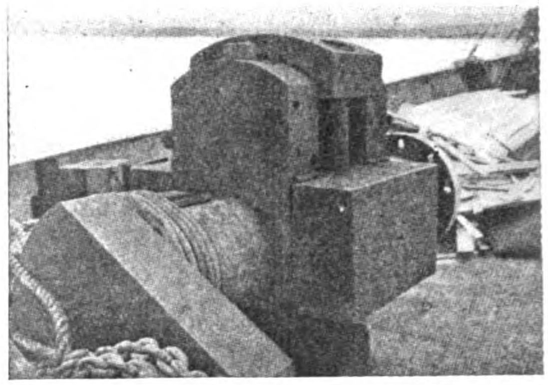


Fig. 3. Heavy casting sent by Burmeister & Wain for a temporary repair assembled on the shaft

At New York a new crank shaft furnished by Burmeister & Wain was installed. Mr. Sylling, as the chief engineer, had the honor to superintend its installation and has remained as chief on board the motorship which has been renamed the "Lidvard."

It is apparent that the connecting rod for the damaged crank was disconnected and the fuel oil and air injection cut off from that cylinder. This condition prevailed for nearly fifteen months of reliable operation at sea and manoeuvering in port. A more practical demonstration that the multi-cylinder Diesel engine is not easily disabled could hardly be imagined.

The above description is a translation of an article published in the Danish periodical "Skibsbygning" and the writer of this English text is indebted to the kind assistance of Mr. C. F. Hansen of the Delaware Ship Building Co., in the translation from the original.

A new illustrated catalogue containing information on marine equipment and ship-fittings has been published by the Vulcan Mfg. Co., Seattle, Wash. Their line includes winches, capstans, shafting, heavy and light castings, etc. The catalogue will be of value to anyone interested in deck machinery, foundry work, or miscellaneous marine fittings.

OIL CARD USED ON AN AMERICAN DIESEL ENGINE

The surest way to avoid trouble is to take such precautions that trouble cannot materialize. The correct distribution of oil for the lubrication of a Diesel engine, is of equal importance to the mechanical adjustments. It is natural to expect that upon first operating under load, lubricating oil will not be used sparingly.

We append herewith a copy of an oil card used upon starting a 6-cylinder 4-cycle engine of 750 b.h.p., on a 30-day, non-stop test in the shops of McIntosh & Seymour Corp., Auburn, N. Y.

Bearing	Amount
Main Crank Pin	Stream
Air Compressor Crank Pin	Stream
Main Bearings	Stream
Air Compressor Piston Pin	Stream
Main Piston Pin	30 drops per min.
Main Cyl. Walls P. & S. sides	15 drops per min.
Low pressure A. C. Piston	3 drops per min.
Med. pressure A. C. Piston	5 drops per min.
High pressure A. C. Piston	2 drops per min.

The first four items are indicated as receiving a "stream"—a quantity which is quite indefinite. Richardson-Phoenix force feed lubricators were used. The streams delivered to the first four parts in the table above varied in size, depending upon the load carried. The main bearings and the connecting rod lower-end bearings received a stream which was about 1/32 in. in diameter, about 1 inch below the orifice in the top of the sight feed box. The table of quantities given above must not be used, however, as a criterion to estimate lubricating oil consumption of a Diesel engine after all the bearings have been worked in.

In any event judgment must be used in adjusting the feeds, as oil which is thrown about without reaching the bearings is of no use. It is safer to have to cut down gradually the supply fed at the beginning of a run than to start with too little oil being fed to the working parts.

"Motorship" Illustrated Patent Record*

Selected Abstracts of Recent Published Patents of Internal Combustion Engines

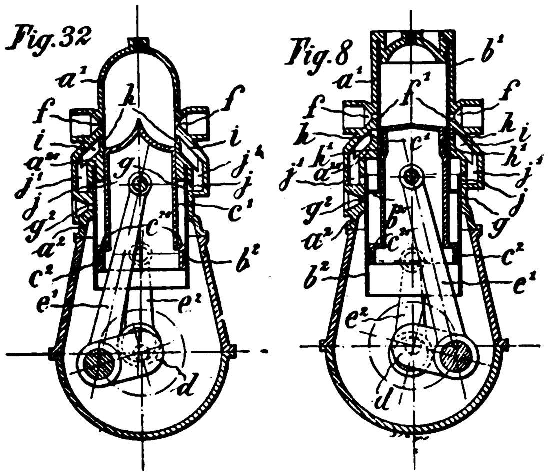
Copies of original specifications may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

***Compiled and described by H. Schreck, Memb. Amer. Soc. Mech. Eng'rs**

1,301,661. Apr. 22, 1919. Two-cycle Engine. H. J. L. M. De La Chevardière & A. Guéret, both of Paris, France.

This patent refers to two-cycle engines and more particularly to multi-cylinder engines having sleeve valves. The object is to obtain engines of greater efficiency.

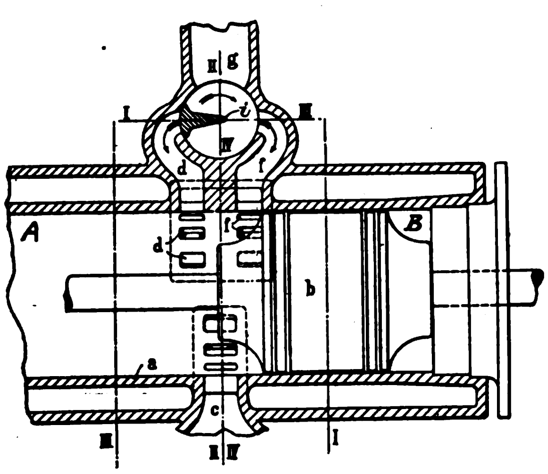
A differential cylinder is provided with a differential sleeve valve which controls the operation of the cylinder, as well as that of the annular space (c^{20}) for the supply of scavenging air. The latter enters at (g^2) and is discharged through (j) into the conduit (i) which is connected with all of the cylinders, and while the scavenging air is discharged at least one of the cylinders will have the ports (h) and (h^1) open to the working cylinder, thus avoiding that the fresh gases being uselessly compressed. (f) is the exhaust port which is uncovered in the usual way shortly before the scavenging air can enter the cylinder.



The inventor presents in Fig. 32 a modified design in which case the differential sleeve valve has been omitted. It is claimed that this engine is not quite as efficient because the exhaust ports remain open a longer time since they remain open during the admission and are covered only when the inlet ports have been covered.

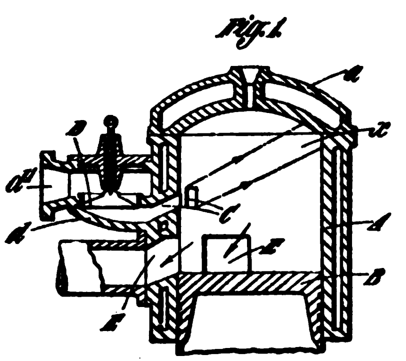
1,114,272. Oct. 20, 1914. K. Kutzbach, of Dresden, Germany, Assignor to The Engine Works Augsburg-Nuremberg, of Nuremberg, Germany.

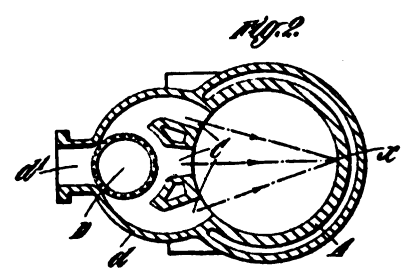
This patent covers again the same method of scavenging but is in this particular case applied to the double-acting two-cycle engine. A and B may represent respectively the upper and lower end or the forward and rear end of a cylinder, then the exhaust gases will escape from both ends through the ports c and the scavenging air will be admitted through d to one end of the cylinder and through f to the other end of the cylinder which is controlled by the position of the rotary valve i.



1,304,443. May 20, 1919. P. Belyan, of Petrograd, Russia and C. G. Roberton, of Barrow-in-Furness, England.

This patent refers to the scavenging of internal combustion engines of the two-cycle type and has for its principal object to provide means by which the products of combustion are displaced by the entering air and driven through the exhaust ports in front of the air without substantial admixture.





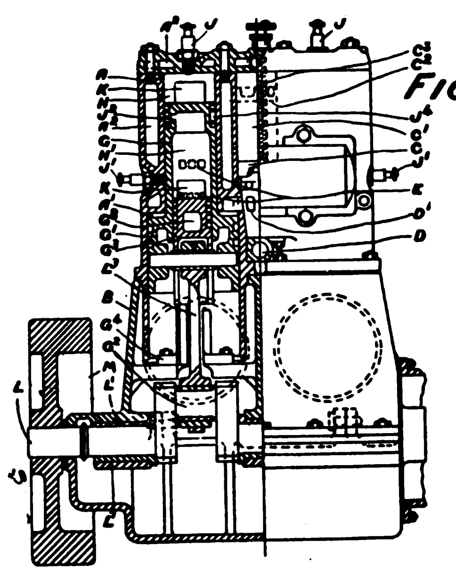
Referring to the illustration the exhaust ports are indicated with E and the scavenging air inlet port by C. When the piston moves downward, that is, while the burnt gases are expanding the scavenging air control valve D is closed. The piston itself will on its downward stroke control the escape of gases through the ports E. After the gases in the cylinder have expanded to atmospheric pressure through the ports E the valve D will be opened and the scavenging air will sweep out the remainder of said gases and fill at the same time the cylinder with fresh air.

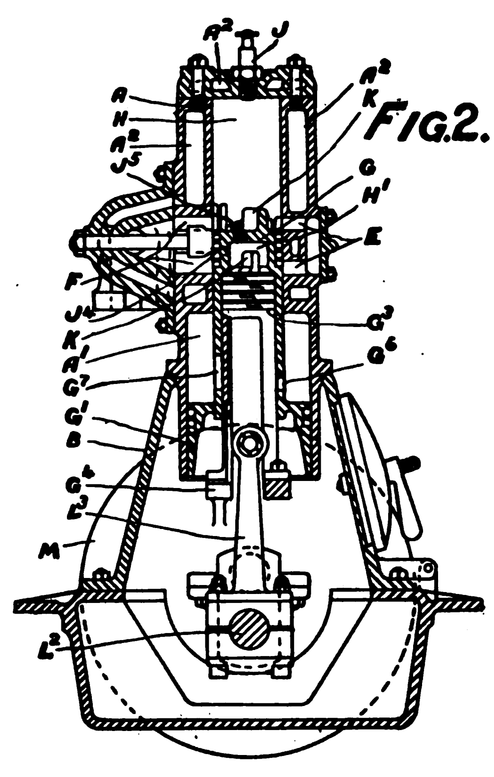
The inventor claims that the air inlet ports are placed above and at the same side of the cylinder as the exhaust ports and are so formed and disposed as to direct the incoming air diagonally to the opposite upper corner of the cylinder and to displace the exhaust gases diagonally from this corner in a reverse direction toward the exhaust.

1,303,598. May 13, 1919. Double-acting Internal Combustion Engine. S. H. Ruddle and E. C. Davidson, both of Brisbane, Queensland, Australia.

This invention refers to a double-acting engine, whose double action is obtained by arranging a pair of pistons one sliding over the other. One of the pistons has a smaller diameter than the other. The smaller one is stationary, is attached to the crank casing at flanges G^4, and projects into the bore of the larger piston. The latter carries at its lower end a piston which is forming a ring space and this serves for the precompression of the charge for the cylinder. F are the exhaust ports for the cylinders.

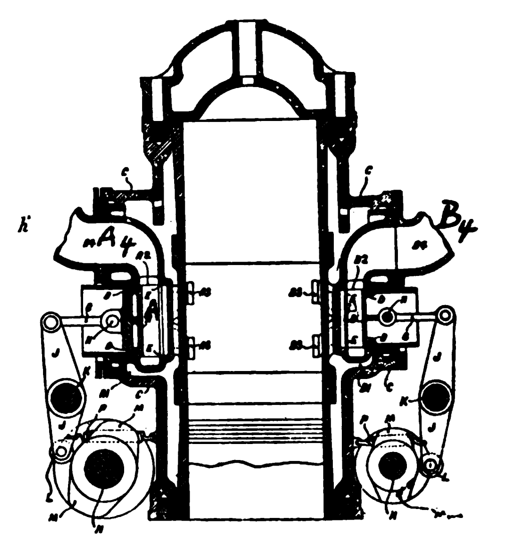
There are two combustion chambers. The upper one of the larger piston G and the other chamber is formed within the bore of this piston G and by the same approaching the smaller stationary piston G^3. When the piston G is in its lowest position the charge inside of same will be ignited through the ignition ports J^2 and by the spark plug J^1, thus driving the piston upward.





124,396. Double-acting Engine. North British Diesel Eng. Wks., and J. C. MacCall Maclagan, both of Glasgow, Scotland (British Patent).

The invention refers to a double acting two-cycle engine with port scavenging. The illustration shows the scavenging valve at (B) and the exhaust valve at (A) and their respective ports to the cylinder bore are clearly indicated. The exhaust outlet and air inlet are shown at (A_4) and (B_4) respectively.

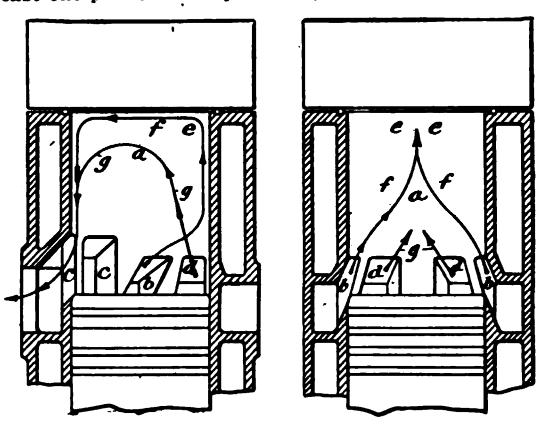


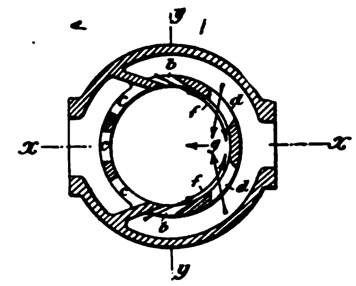
This illustration is exceedingly interesting, as it shows for the first time to the writer's knowledge a "double"-acting two-cycle engine with "port scavenging." It gives us some inside information on what has been done on the other side during the war. It may be recalled that the above-named company was founded in about 1913 for the purpose of building two-cycle engines under the license of Krupp, whose engine has the scavenging valves in the cylinder head.

1,075,603. Oct. 14, 1913. A. F. von Schmidt, of Munich, Germany, Assignor to Busch-Sulzer Bros. Diesel Engine Co., of St. Louis, Mo.

This patent covers exactly the same way and manner of scavenging as No. 1,304,443. The only difference is in the direction of the current in which the exhaust gases and the scavenging air are forced to flow.

The inventor claims an arrangement of admission ports for the scavenging charge, in such a way that at least one pair of these ports b b, which are opposite to each other, have such a direction, that their scavenging current flows upward along the cylinder wall, while the other admission ports d d are so directed that their air current chiefly scavenges the central part of the cylinder.





The two-cycle engines of Busch-Sulzer Bros., of St. Louis, have been built under this patent and the arrangement has proven to be very successful.